

Winter 1987

# The Ronson ship: The study of an eighteenth-century merchantman excavated in Manhattan, New York in 1982

Warren Curtis Riess

*University of New Hampshire, Durham*

Follow this and additional works at: <https://scholars.unh.edu/dissertation>

---

## Recommended Citation

Riess, Warren Curtis, "The Ronson ship: The study of an eighteenth-century merchantman excavated in Manhattan, New York in 1982" (1987). *Doctoral Dissertations*. 1527.

<https://scholars.unh.edu/dissertation/1527>

This Dissertation is brought to you for free and open access by the Student Scholarship at University of New Hampshire Scholars' Repository. It has been accepted for inclusion in Doctoral Dissertations by an authorized administrator of University of New Hampshire Scholars' Repository. For more information, please contact [nicole.hentz@unh.edu](mailto:nicole.hentz@unh.edu).

## INFORMATION TO USERS

The most advanced technology has been used to photograph and reproduce this manuscript from the microfilm master. UMI films the original text directly from the copy submitted. Thus, some dissertation copies are in typewriter face, while others may be from a computer printer.

In the unlikely event that the author did not send UMI a complete manuscript and there are missing pages, these will be noted. Also, if unauthorized copyrighted material had to be removed, a note will indicate the deletion.

Oversize materials (e.g., maps, drawings, charts) are reproduced by sectioning the original, beginning at the upper left-hand corner and continuing from left to right in equal sections with small overlaps. Each oversize page is available as one exposure on a standard 35 mm slide or as a 17" x 23" black and white photographic print for an additional charge.

Photographs included in the original manuscript have been reproduced xerographically in this copy. 35 mm slides or 6" x 9" black and white photographic prints are available for any photographs or illustrations appearing in this copy for an additional charge. Contact UMI directly to order.



Accessing the World's Information since 1938

300 North Zeeb Road, Ann Arbor, MI 48106-1346 USA



**Order Number 8807192**

**The Ronson ship: The study of an eighteenth century  
merchantman excavated in Manhattan, New York in 1982**

**Riess, Warren Curtis, Ph.D.**

**University of New Hampshire, 1987**

**Copyright ©1987 by Riess, Warren Curtis. All rights reserved.**

**U·M·I**

**300 N. Zeeb Rd.  
Ann Arbor, MI 48106**



**PLEASE NOTE:**

In all cases this material has been filmed in the best possible way from the available copy. Problems encountered with this document have been identified here with a check mark ✓.

1. Glossy photographs or pages \_\_\_\_\_
2. Colored illustrations, paper or print \_\_\_\_\_
3. Photographs with dark background ✓
4. Illustrations are poor copy \_\_\_\_\_
5. Pages with black marks, not original copy ✓
6. Print shows through as there is text on both sides of page \_\_\_\_\_
7. Indistinct, broken or small print on several pages \_\_\_\_\_
8. Print exceeds margin requirements \_\_\_\_\_
9. Tightly bound copy with print lost in spine \_\_\_\_\_
10. Computer printout pages with indistinct print \_\_\_\_\_
11. Page(s) \_\_\_\_\_ lacking when material received, and not available from school or author.
12. Page(s) \_\_\_\_\_ seem to be missing in numbering only as text follows.
13. Two pages numbered \_\_\_\_\_. Text follows.
14. Curling and wrinkled pages \_\_\_\_\_
15. Dissertation contains pages with print at a slant, filmed as received \_\_\_\_\_
16. Other \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

U·M·I



**THE RONSON SHIP:  
THE STUDY OF AN EIGHTEENTH CENTURY MERCHANTMAN  
EXCAVATED IN MANHATTAN, NEW YORK IN 1982**

**BY**

**WARREN CURTIS RIESS  
B.A., Nasson College, 1972  
M.S., Texas A&M University, 1980**

**DISSERTATION**


**Submitted to the University of New Hampshire  
in Partial Fulfillment of  
the Requirements for the Degree of**

**Doctor of Philosophy  
in  
History**

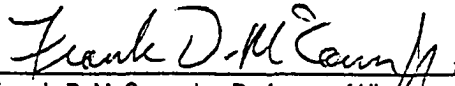
**December, 1987**



This dissertation has been examined and approved.



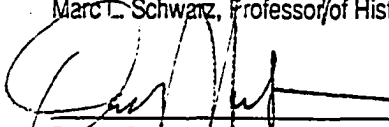
Dissertation director, Charles E. Clark  
Professor of History



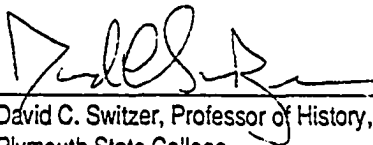
Francis D. McCann, Jr., Professor of History



Marc L. Schwarz, Professor of History



Darrett B. Rutman, Professor of History,  
University of Florida



David C. Switzer, Professor of History,  
Plymouth State College

December 4, 1987  
Date

ALL RIGHTS RESERVED  
COPYRIGHT 1987  
WARREN CURTIS RIESS

**To my parents,  
who have not always understood why I chose my path,  
but always supported me along the way.**

## ACKNOWLEDGMENTS

The Ronson ship investigation was made possible by the hard work and support of all the people involved with the project during the past five years. A special thanks is due Shelli Smith, my partner in research and family, who often set a rigorous pace, provided an anthropological conscience, and has been my collaborator in this study since the first day we saw the ship's timbers in Manhattan. I wish to express my gratitude, for their suggestions and comments, to the members of my dissertation committee, Dr. Francis McGann, Dr. Marc Schwarz, Dr. David Switzer, and especially to Dr. Charles Clark and Dr. Darrett Rutman, who encouraged and guided this study from the very beginning.

Howard Ronson and his associates, cognizant of the historic value of the site, supported the investigation well beyond government and business requirements. The close cooperation of the people at H.R.O., Ltd., Fox and Fowle Architects, Soil Systems, Inc., George Fuller Construction Company, and the New York Historic Landmarks Preservation Commission supported the excavation, recording, analysis, and preliminary historical research for the ship and the recovery and conservation of the bow. The field crew, who accomplished the excavation under very harsh conditions, serve as an example of dedication overcoming adversity.

Between May 1982 and May 1985 the constant attention of Heidi Micsh, Ken Morris, Betty Seifert, and Seifert's conservation staff guaranteed the preservation of the bow and many key artifacts. The gathering of remains, notes, photographs, and illustrations and the continued analysis of all the material was made possible by the efforts of the Board of Directors, staff, and volunteers of The Mariners' Museum, especially staff members Linda

Kelsey, Richard Malley, Lois Oglesby, John Sands, Paul Sullivan, and William Wilkinson and volunteers William Ackiss, Linda Brown, Gere Cobb, Kyle Conard, Al Foster, Ed Hoffman, Katherine Kelly, George Matson, Joe Powell, Virginia Powell, and Linda Rogers.

Helpful suggestions for field work, research, and writing came from many other people during the past five years, especially from George Bass, Norman Brouwer, Amy Friedlander, Richard Jagels, Ellen Lockwood, David Lyon, David MacGregor, Kerry Shackelford, MacClean Shakeshober, J. Richard Steffy, Peter Throckmorton, and Gordon Watts.

1982 Field Staff: Warren Riess and Sheli Smith, Co-directors; Jay Cohn and Bertrand Herbert, Crew Chiefs; Robert Adams, Jay Allen, Thomas Amorosi, David Babsen, Kathy Biddick, Quentin Blaine, Debra Brodie, Eugene Boesch, Laurie Boros, Bobbi Lynn Brickman, Eric Clingen, Nicole Coolidge, Ellen Cosby, Ann Marie Cuskley, Valerie DeCarlo, Joseph Diamond, Anne Donadeo, Claire Falco, Andrea Foster, Elaine Friedman, Peggy Froeschauer, John Froeschauer, Edwina Gluck, Lisa Goldberg, Steven Gross, Laurel Harrison, Fred Harvey, Faith Hentshel, Peter Hentshel, Kerry Horn, Dana Howe, Abby Jaroslow, Sarah Keyishian, Marc Kodack, S. Ruby Lang, Jim Lally, Ann Marie Lunsford, Sam Margolin, Lee Margolis, Claudia Marshall, Barbara Mehrhof, H. James Merrick, William Moran, George Myers, Steven Nicklas, Philip Perazio, Valerie Perazio, Amy Pickell, Sissy Pipes, Jesse Ponz, Drew Pritsker, Keith Reiner, David Robinson, Julie Rosen, Jay Rosloff, Patricia Seabury, Richard Shallenberger, Scott Simpson, Annette Silver, Anne Somoroff, Ella Stewart, Barbara Stidworthy, Avery Stone, Richard Swete, and Debra Tiller.

## TABLE OF CONTENTS

	PAGE
LIST OF ILLUSTRATIONS .....	viii
ABSTRACT .....	xi
INTRODUCTION .....	1
CHAPTER	
1. EXCAVATION OF THE SITE .....	7
2. IDENTIFYING THE SHIP .....	32
3. BUILDING THE SHIP .....	60
4. DESIGNING THE SHIP .....	83
5. CAREER AS A MERCHANTMAN .....	114
6. BURIAL IN NEW YORK .....	135
7. CONCLUSIONS .....	165
BIBLIOGRAPHY .....	171

## LIST OF ILLUSTRATIONS

FIGURE	PAGE
<b>CHAPTER 1</b>	
1 Locational Map of Manhattan.....	8
2 Outside of Hull Seen in Deep Test.....	10
3 Site Map of 175 Water Street with Ship and Lot Numbers.....	13
4 Stratigraphy Within Ship in Lot 32.....	15
5 Measuring Systems Used to Record Ronson Ship.....	17
6 Full Scale Tracing of Bow Timber.....	20
7 Profile and Cross-Section of Ronson Ship.....	22
8 Typical Midship Frame Construction.....	25
9 Collapsed Lower Deck in Lots 32 and 33.....	27
<b>CHAPTER 2</b>	
10 Ronson Ship Lines.....	35
11 Scarph Joints.....	40
12 Comparative Waterways.....	42
13 Derelict in 1717 Burgis View.....	45
<b>CHAPTER 3</b>	
14 Station Cross-Section Using Deane Method.....	62
15 Hahn Diorama Showing Scribe Board in Use.....	69
16 Sketch of Shipwrights Charring Planks.....	74
17 Lead Stripping Between Wales.....	78

FIGURE	PAGE
<b>CHAPTER 4</b>	
18 Example of Ship Lines.....	87
19 Sketch of Blunt and Sharp Bows.....	91
20 Comparative Cargo Areas.....	94
21 Ronson Ship Bow.....	95
22 Comparative Sterns.....	97
23 Deane Method of Planning Warship Profile.....	101
24 Deane Method of Planning a Cross Section.....	102
25 Test of Arcs on Ronson Ship Design.....	104
26 Ronson Ship Cross-Section Using Deane Method.....	105
27 Radii of Arcs for Stem and Breast Hook.....	106
28 Square Frames.....	108
29 Cant Frames.....	110
<b>CHAPTER 5</b>	
30 Wharf Lifting Devices.....	120
31 Cross-Section of Ronson Ship Showing Cargo and Ballast.....	122
32 Profile of Ronson Ship Loaded with Hogsheads.....	124
<b>CHAPTER 6</b>	
33 Pre-Columbian Map of Manhattan.....	136
34 View of Manhattan in Dutch Period.....	140
35 Stone Dock on Southeast Shoreline of Manhattan.....	141



FIGURE	PAGE
CHAPTER 6, cont'd.	
36 Burgis View of Manhattan.....	143
37 Low and High Water Marks.....	145
38 1756 View of Manhattan with Quays and Slips.....	146
39 Block Map of 175 Water Street.....	148
40 Early Development of 175 Water Street.....	150
41 Grim's Map of New York.....	152
42 Maershalck's Map of New York.....	153
43 Fill Stratigraphy in Ronson Ship.....	156

## ABSTRACT

### THE RONSON SHIP: THE STUDY OF AN EIGHTEENTH CENTURY MERCHANTMAN EXCAVATED IN MANHATTAN, NEW YORK IN 1982

BY

WARREN CURTIS RIESS

University of New Hampshire December, 1987

During a pre-construction archaeological investigation at 175 Water Street, Manhattan, New York in 1982, excavators discovered an eighteenth-century merchant ship. The port side of the ship was excavated and recorded and the bow was taken apart and saved. Since that time historical and archaeological studies have been conducted to interpret the site to glean information about eighteenth-century technology and economics. The remains of this ship are particularly important because no draft or other remains of early eighteenth-century transatlantic merchantmen have been discovered.

The ship appears to be a Virginia-built ship which sailed between the Chesapeake and England or Scotland carrying tobacco to the British Isles and various European goods to America. The exact identity of the ship has not been determined. Details of the ship suggest that she was designed with a seventeenth-century geometric technique to have a good cargo-to-crew ratio and was built soundly but without great expense. Why the ship eventually ended its sailing career in New York is not clear, but an inspection of data from the site allows a reconstruction of the methods used to create the city block over the East River.

## INTRODUCTION

Most people's images of maritime activities in the colonial period are limited to warships, pirates, and Washington crossing the Delaware.<sup>1</sup> Rarely do they conjure up images of the more numerous merchant ships which were plying the oceans as the major means of communications between the peoples of the world 250 years ago. From the beginning of civilization to the mid-twentieth century, merchant ships were the carriers of people, raw materials, manufactured goods, food, news, and disease between communities separated by large bodies of water. Even for communities connected by contiguous land, communication by ships and coastal boats was most often faster, safer, and cheaper than land travel. A better understanding of the transatlantic vessels would provide important insight into the colonial period, for overseas trade shaped the economic history of British America.<sup>2</sup> But merchant ships were too familiar to catch the imagination of contemporary or modern readers and writers.

Historians have rarely addressed colonial era merchant ships, except as wooden containers which brought people and cargo to and from various places. This superficial treatment comes more from a lack of surviving information than from a lack of interest. The paucity of surviving information is probably due to a lack of interest in keeping and preserving records on such a mundane subject. Even with the modern interest in the preservation of records, especially on microfilm, only a few repositories preserve information concerning merchantmen.

Our knowledge of eighteenth-century commercial ships is limited to registration records of port officials, a few illustrations which show the upper works and hulls of various ships, and few written descriptions. The only known surviving detailed illustrations of pre-nineteenth-century merchantmen was published in Sweden in 1768.<sup>2</sup> Archaeological evidence has also been meager. Most discovered ships are being destroyed by would-be treasure salvors. Nautical archaeologists, by chance and preference, have investigated only a few merchant vessels worldwide -- none of which were the common oceanic cargo carriers of the eighteenth century.

The 1982 discovery and excavation of an early eighteenth-century merchant ship, buried beneath the earth at 175 Water Street in Manhattan, was a possible source of important information about the old commercial vessels. In January and February, Shelli Smith and I directed a careful excavation and recording of the burial site of the ship. With construction crews working and waiting around them, Smith and her recording crews extracted data from the ship and its fill without having the time to stop and analyze the site. Whether or not we could determine the exact role this vessel played in America's early trade, we felt we could glean information from the site to help us understand merchant ships and the colonial merchant trade in general.

To make the most of the data from the site we needed to conduct both an archaeological and historical study at the same time. The complementary combination of the two disciplines enabled this study to be more thorough than could have been possible through the sole use of either discipline independently, because neither archaeological nor historical resources were complete. After the excavation, I started a search for the identification of the ship in

hopes of studying the ship's history in addition to its physical remains. Concurrently we initiated a major conservation effort to preserve the bow and many of the artifacts found in the ship. In 1985 Howard Ronson, the developer of 175 Water Street who made this investigation possible, gave the bow and all the artifacts associated with the ship to The Mariners' Museum of Newport News, Virginia. I followed the collection to Virginia to help sort out the enormous puzzle of the collection of bow pieces and artifacts and to continue the study of the ship and her artifacts. At The Mariners' Museum we created a part-time team of talented staff and volunteers to continue the conservation treatments and study the collection.

Eventually we discovered a good deal about the way the ship was designed and constructed. By adding this new data, coupled with archival and other archaeological information, I have attempted to fill gaps and answer some questions that exist in the study of colonial maritime history. However, two major problems were not overcome and had to be kept in mind throughout the interpretation: 1) I was not able to identify the vessel as a particular ship and 2) the vessel was only one example of a relatively unknown type of ship. The first problem is a great frustration which continues to haunt the research project. A team of volunteers and I have studied all sources which might have yielded the name of the ship within a reasonable amount of time. Today the search continues through the slow study of less direct sources. To write this report when a key part of the research project is unfinished may seem presumptuous, yet to wait until all sources are exhausted would delay the production of this manuscript for many years with no guarantee of results.

Just as the lack of an exact identity requires caution when developing a history from the data, the fact that this is only one example of an eighteenth-century merchantman limits the

interpreter's reliance on the ship's remains for general conclusions. Though details of the ship imply a tradition in design and building, the percentage of ships built like this one can not be approximated. The ship reflects a logical solution to several problems facing shippers at the time, but at present I cannot say whether it reflects a general trend or one man's anomalous solution.

With these reservations in mind I present the methods and results of this study in six chapters which describe the archaeological and historical investigation of the Ronson ship site. First I explain how we obtained the archaeological data in a hurried excavation in Manhattan, then the methods and results of the attempt to identify the ship. The remaining four chapters deal with determining the history of the ship, from its design to its burial in New York, roughly parallel to its conception, birth, life, death, and burial. Though chronologically the ship was designed before it was built, archaeological data and research about the construction techniques led to conclusions about the design. Therefore I have presented the construction details in Chapter Three, in order to allow the reader to follow the reasoning about the ship's design in Chapter Four.

To further interpret the technical conclusions of the study I have placed the ship's probable use and characteristics in historical context in Chapter Five by presenting a "typical" voyage across the North Atlantic. Though the reader must keep in mind some serious disclaimers, it is a useful exercise to place the ship in its milieu. The story may change as new information is discovered through continued research, but the changes should not be major. The final chapter is an analysis of the site to determine the methods and chronology of the development of the 175 Water Street block. Archival material and a close inspection of the stratigraphy and artifacts found within and around the ship allow a look at

the eighteenth-century efforts to fill this area of the East River. I hope the chapter is useful not only to maritime historians who are interested in the development of port facilities, but also to urban historians and archaeologists who study the creation of land in port cities.

Piecing the following study together from distant and different types of information leaves this researcher humble in the hope that the threads with which he binds historical and archaeological information together are not too thin. I apologize to those people who designed, built, sailed, and buried the ship if I have misinterpreted what they left behind.

## NOTES, INTRODUCTION

1. Survey made by author of 12 neighbors in Newport News, Virginia, August 1987.
2. John J. McCusker and Russel P. Menard, *The Economy of British America, 1607-1790: Needs and Opportunities for Study* (Williamsburg, 1980), 6.
3. Fredrik Henrik af Chapman, *Architectura Navalis Mercatoria* (New York, 1968 [orig. publ. Stockholm, 1768]).



## Chapter One    Excavating the Site

In October 1981, archaeologists began a pre-construction investigation of 175 Water Street, a city block in lower Manhattan. The land, originally a shallow area of the East River, had been cribbed and filled in the eighteenth century. H.R.O., Inc., a Howard Ronson development corporation, was preparing to construct a thirty-story office building at the site. In order to do so, they were required by the New York City Landmarks Preservation Commission to conduct the archaeological study, which would include excavation, analysis, interpretation, and publication of the investigation. Fox and Fowle Architects, as agents for H.R.O., hired the contract archaeology division of Soil Systems, Inc. to conduct the necessary archaeological study (See Figure 1).

Soil Systems' vice president Pat Garrow managed the project and Dr. Joan Geismar was hired to direct the site investigation. Before Geismar's team began excavating, Dr. Amy Friedlander researched the history of the city block in order to give direction to the archaeological investigation. From contemporary maps she found that the site had been filled between 1745 and 1755. Subsequently, small commercial buildings were constructed there, the last being in the nineteenth century. These commercial buildings were torn down between 1956 and 1960, and the block paved to become a parking lot.

Because of time constraints and the high costs involved in working in New York City, Geismar's research design called for a careful study of only approximately one-sixth of the

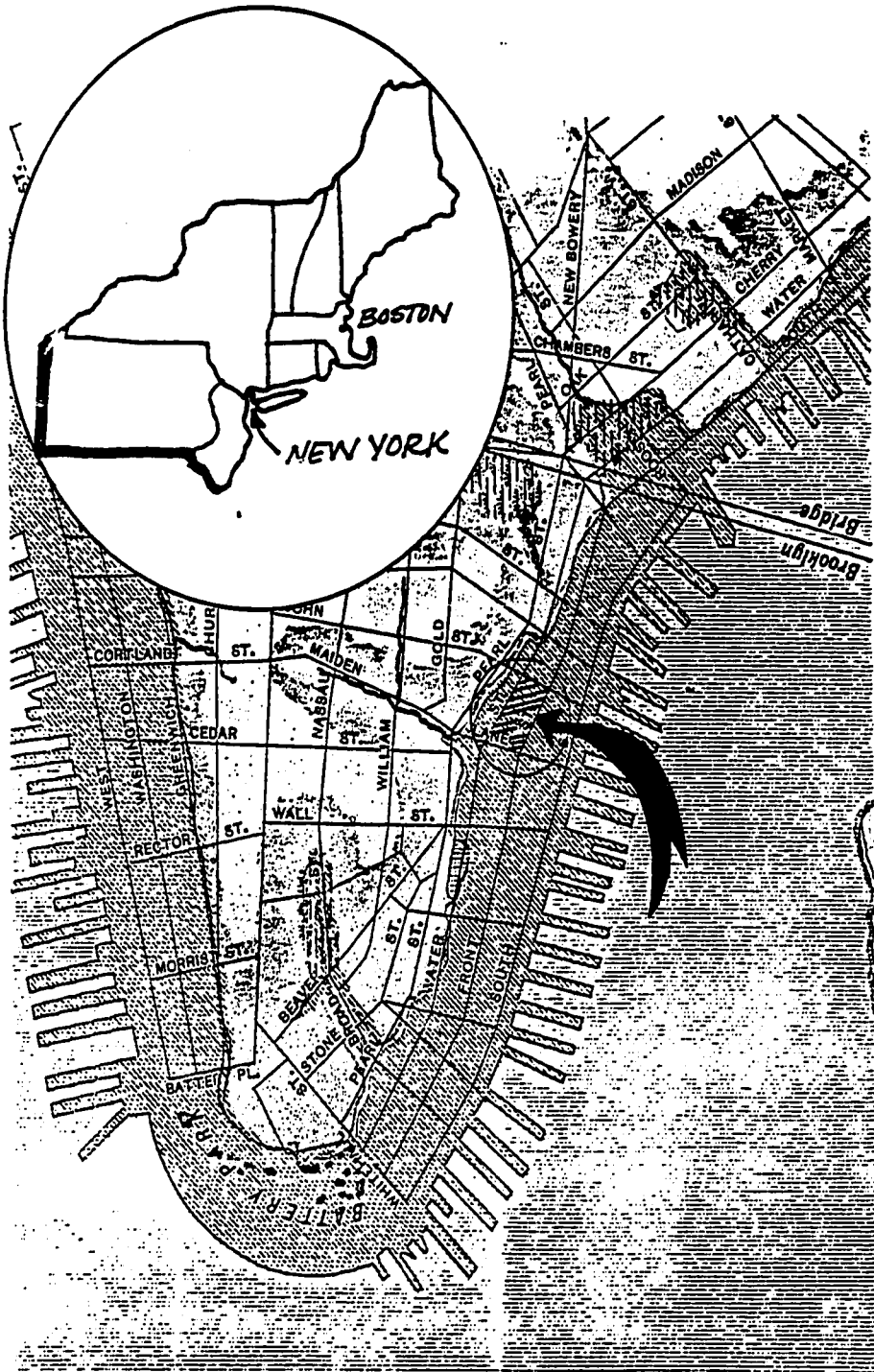


Figure 1. The southern tip of Manhattan, showing the original land and the present outline after approximately 300 years of filling (shaded area). The arrow points to 175 Water Street. From map by T. MacCowan, "1609, The Island of Manhattan at the Time of Discovery." (S. Smith)

one-acre block and a series of four deep tests in the rest of the area. A deep test consisted of a backhoe-dug hole approximately 10 feet by 4 feet by 12 feet deep. An archaeologist was lowered into the deep test hole to record the stratigraphy, which was compared to the stratigraphy of the carefully excavated area.

As the archaeologists dug below the asphalt in the hand-excavated area they uncovered many building foundations, back yards, wells, and privies. The site contained artifacts dating from the mid-eighteenth century to the twentieth century. Discounting building material, micro- and macroflora fragments, and bone material, approximately 310,000 counted objects were recovered on the site.

Early in January 1982, a month before the end of the allotted time for field archaeology, the last deep test was dug in the east-central area of the block. The mud on the hole's east wall quickly fell away to reveal the outside planking of an old wooden ship. Norman Brower, Maritime Historian at the South Street Seaport Museum, and I were called in by Soil Systems to evaluate its significance. On January 12, in the midst of a snow storm, I was lowered into the deep test hole in the bucket of a back hoe. The wall of wood exposed in the deep test hole was the outer surface of a large sea-going vessel from the age of sail (See Figure 2). One-inch (2.5 cm.) sheathing planks of worm-eaten soft wood covered most of the visible hull. Where it was broken away we could see thicker planks of oak covered with animal hair and pitch beneath the 1-inch (2.5 cm.) sheathing. This was an old method of protecting a ship from teredos (ship worms). The teredos had penetrated the softwood sheathing, but had not crossed the pitch to enter the outer planking of the hull itself.

The size of the timbers, the hair, pitch, and wood sheathing, and the fact that they were fastened with octagonal trunnels, indicated that the ship was a medium-to-large

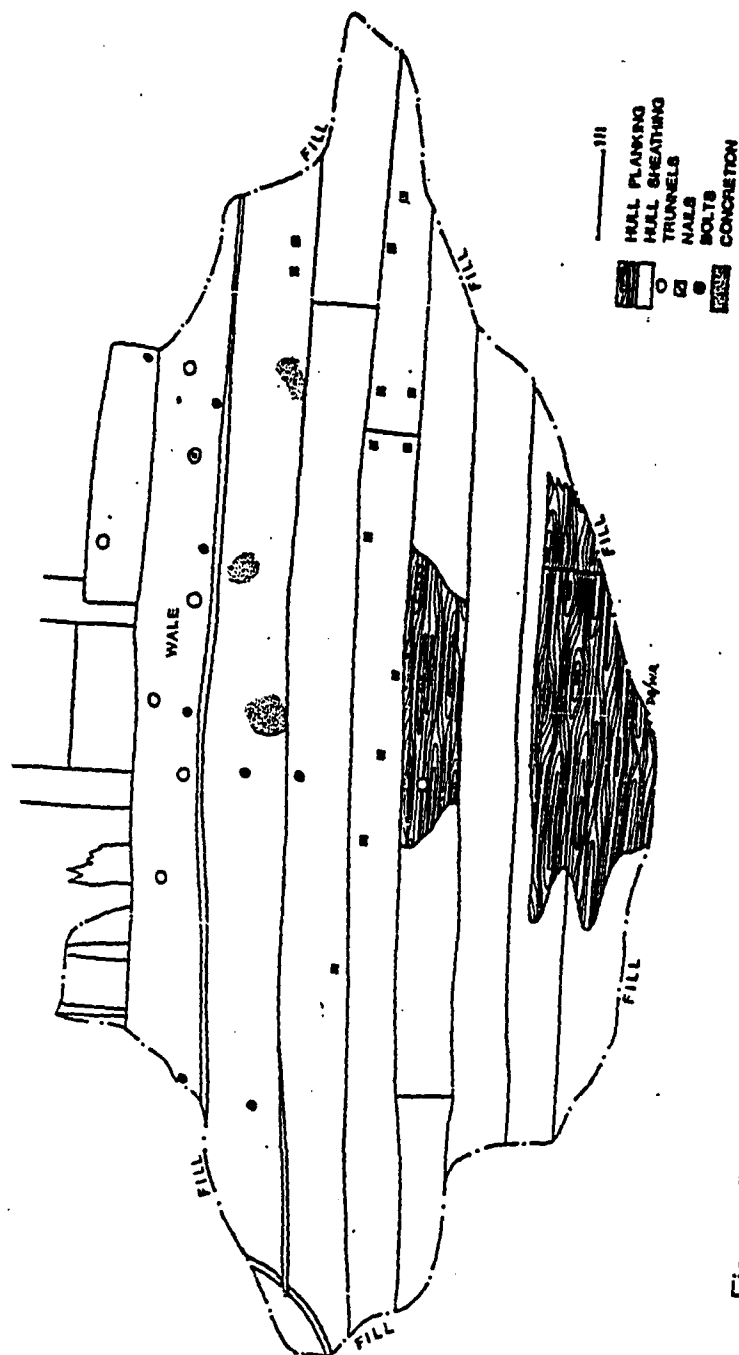


Figure 2. Outer hull of the Ronson ship, as seen in the deep test hole, January 12, 1982. Port side near frame 21. (D. Brodie and W. Rless)

merchantman from the eighteenth century. No common merchantman from that period had ever been studied archaeologically. Excited by the integrity of the exposed hull and the degree of preservation of this rare find, Geismar allowed me to excavate a 10-by-10-foot (3 by 3 m.) test pit inside the ship to discover more about her size, degree of preservation, and contents. I called Sheli O. Smith, a nautical archaeologist (and my wife), to join us in the field.

After a backhoe removed a layer of asphalt, 7 feet (2.1 m.) of overburden, and the floor of a nineteenth-century basement, Bert Herbert and George Myers, of Soil Systems, and I dug with shovels inside the vessel's hull. We were surprised to find a layer of white coral sand and another of granite cobblestones. During the second day of excavating the test pit, just as Smith joined us, we uncovered a deck of the ship, 12 feet (3.6 m.) below the present street level. After one week, the pit revealed a gunport on the western side, a large cargo hatch on the east side with a monkey post ladder protruding from it, and a possible small hatch that had been planked over 200 years earlier.

By measuring from the monkey post, assumed to be in the center of the ship, to the outside of the hull we calculated that the ship had a beam of 25 feet (7.5 m.) and, since most eighteenth-century ships had a length-to-breadth ratio of between 3 and 4-to-1, a length of 75 to 100 feet (22-30 m.). Most old ship remains are discovered on the ocean bottom, where only the very lowest section of the hull remains intact. From our test excavation we estimated that this vessel probably was intact from well above the waterline to the keel. The deck we uncovered was her lower (gun or main) deck. Her orientation indicated that she lay on an approximate north-south axis with her eastern side (starboard) and most of her

southern end (stern) under Front Street (See Figure 3). While we realized that this was the first major discovery of a colonial merchant ship which had a chance to be thoroughly studied, only one week remained before the archaeological deadline.

We decided to ask for more time, presented a proposal to Ronson's agents and the New York Landmarks Commission, and were granted the time and budget necessary to excavate and record that part of the ship not directly under Front Street and its sidewalk. Aware that any delays would cost the developer thousands of dollars a day, we developed a plan which would be thorough and quick. The crew was split into four units: an excavation team of thirty-five people; a wood recording team of four, who measured, sketched, and photographed each piece as it was removed from the site; a hull recording team of four; and a support staff of three. The plan also called for an extra month to work (February), a six-day work week, two backhoes, five pumps to keep the site drained, and other equipment to streamline the field work.

The backhoe operators immediately cleared away 6 to 8 feet (1.8-2.4 m.) of asphalt, concrete, and nineteenth-century warehouse rubble that lay over the ship. On the first day of February the crew assembled to begin hand-excavation. As we began, we realized that nineteenth-century building foundations still lay over the ship, their walls running across the hull, athwartships. Soil Systems' safety engineers felt that we should leave the walls in place to help prevent the sides of the ship from collapsing on the crew while they excavated. Physically restrained from inspecting the whole ship, we therefore adopted the street numbers of the former buildings to designate the excavation units on the vessel. The bow was in Lot 31 and the stern was in Lot 35 (See Figure 3).

During the grueling New York winter the excavation crew shoveled and troweled down

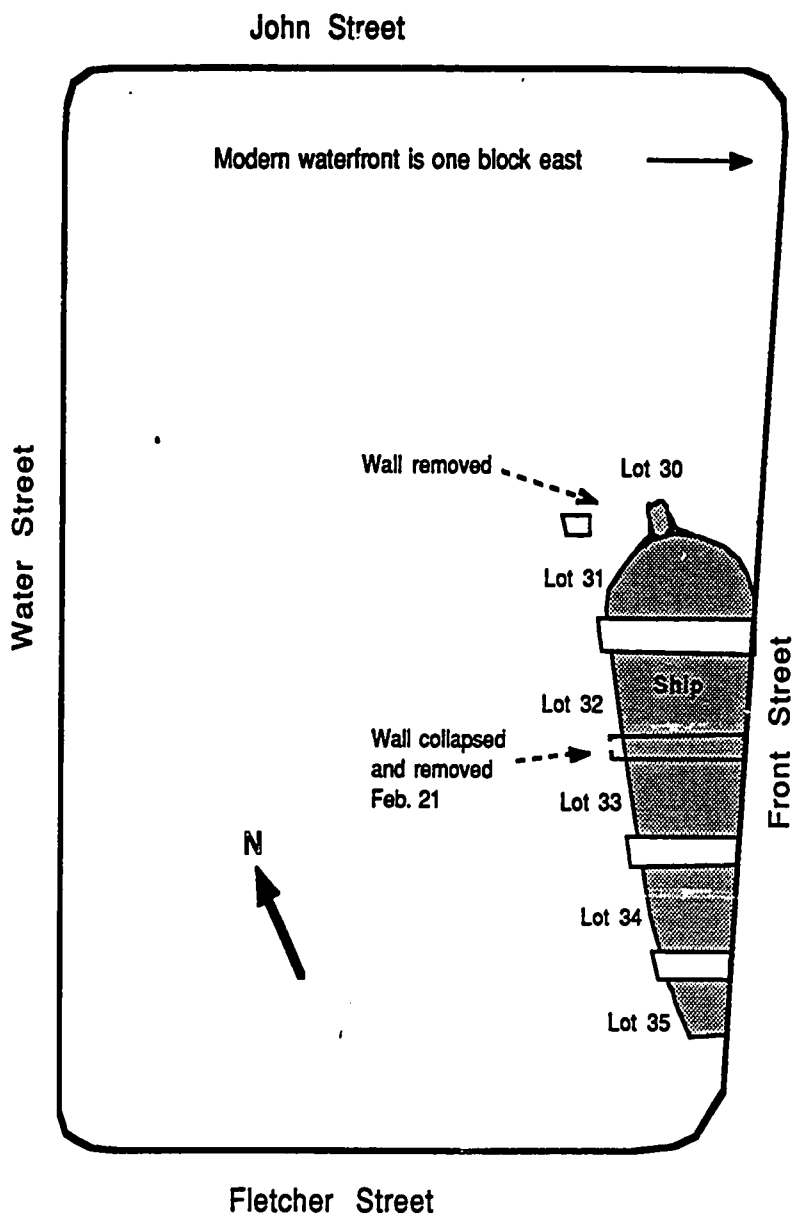


Figure 3. Site map of 175 Water Street with ship and former street numbers indicated. (W. Riess)

through the fill in the ship. Distinct layers of fill occupied the hull; therefore each layer within each lot was described as a distinct 'locus.' Excavators recorded the top surface of each locus, removed the layer, and recorded the top of the next locus. They kept a 10% sample of each layer and recorded the stratigraphy when a few loci had been excavated (See Figure 4).

Obvious artifacts within each locus were recorded and kept. As they dug, the archaeologists shoveled backfill into five-gallon buckets, retaining every tenth bucket of backfill for sample testing. The sample buckets were washed for small artifact retrieval and 'float tests' of the soil were conducted to retrieve seeds and other floating remains. We felt that only the bottom layer of fill, and anything below the ceiling planking and between the frames, might be originally from the ship. That material was all carefully screened for artifacts. The remaining fill was discarded.

In order to facilitate recording of the site in the time allotted, we used recording methods we had devised for underwater use, where measuring time is always a precious commodity. Eschewing the common terrestrial archaeology technique of measuring in rectilinear coordinates of X, Y, and Z (east, north, and down), we constructed 5-by-5 foot (1.5-by-1.5 m.) grids over each excavation unit and used three measuring tapes from particular points on the grids to record each point of the site. Since the positions of the points on the grid relative to the whole site were known, and there was only one mathematical solution for each point below the grid, the rectilinear position of each point could be calculated later.<sup>1</sup>

The excavation crews and the recording team used this trilateration method for the majority of measurements taken on the site. To develop plans of the shape of the hull, however, many of the ship's frames had to be measured separately. The recording team took



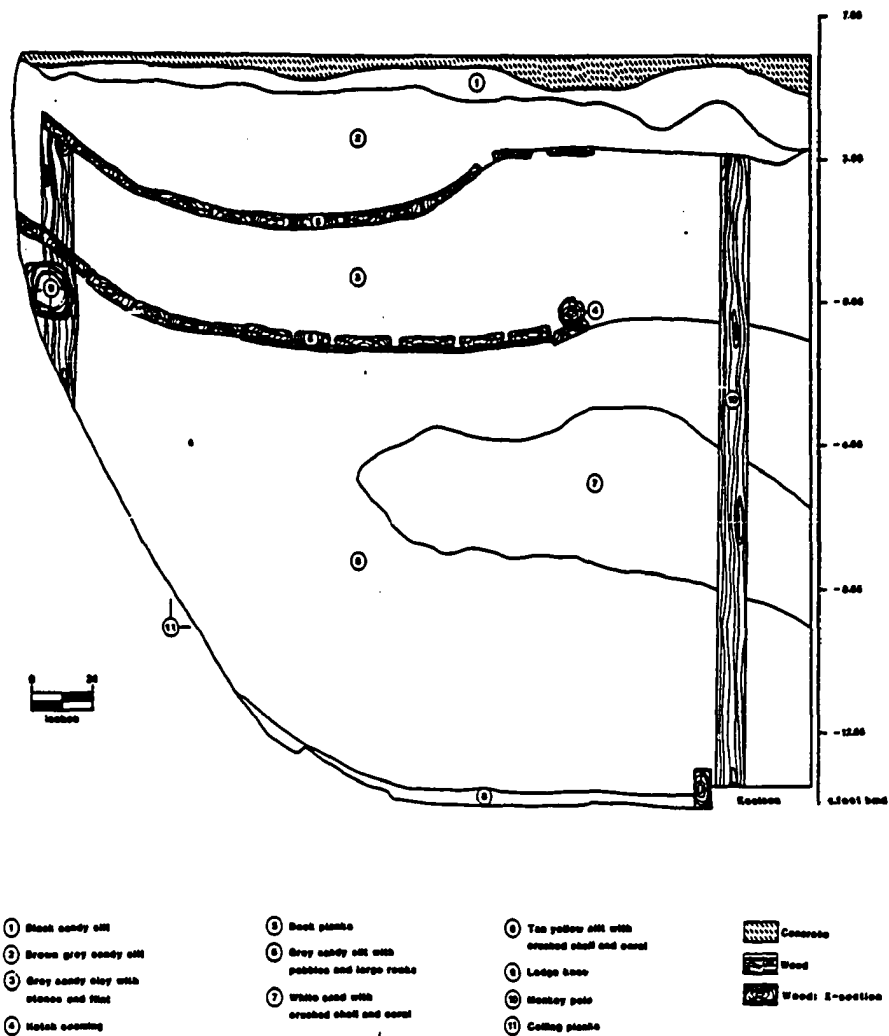
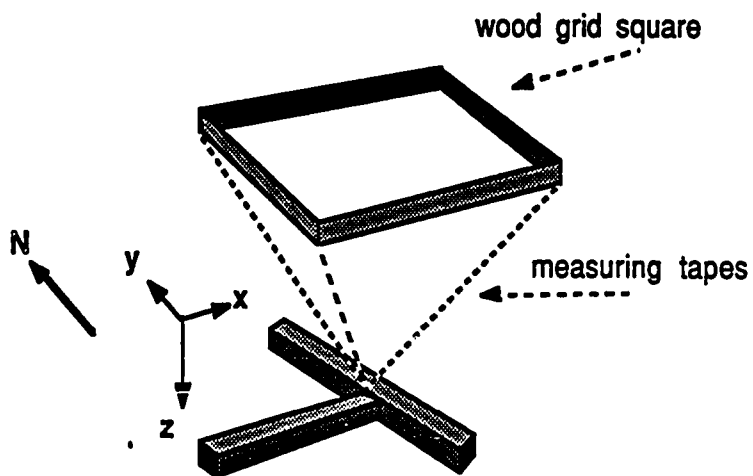


Figure 4. Stratigraphy of the north face of lot 32, showing the collapsed lower and upper decks. (B. Herbert)

fourteen stations -- that is, recorded the shape of the outside of fourteen frames along the length of the hull -- by erecting a pole with a large protractor over each desired frame and measuring the angle and distance to several points along the outside edge of the frame (See Figure 5). The data was later reduced mathematically and graphically to construct standard lines for the hull, by which the vessel can be compared to any other ship. In addition to making thousands of measurements, sketches, and notes, we took approximately two thousand photographs of the site during various phases of the excavation. Measurements were taken to the nearest 1/4-inch (0.6 cm) or 1-degree, which allowed an accuracy of 1 inch (2.5 cm).

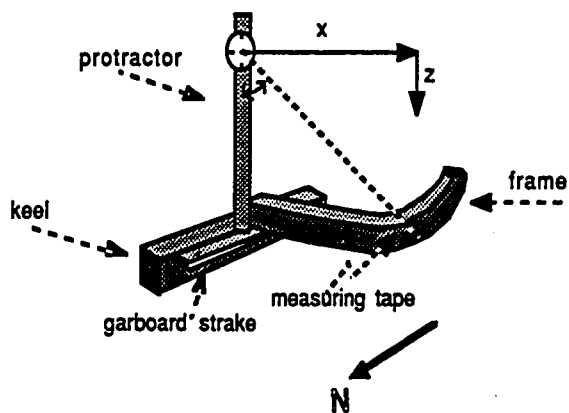
By February 28 the team had excavated most of the ship and Mayor Koch led the way as 12,000 people viewed the site from a special balcony constructed by Fuller Construction Company. However, the future of the ship's remains was still a problem. The hull could not stay in place because the new office building was to be supported by more than 300 steel piles. We had carefully recorded the dimensions and shapes of every timber so that the ship could be recreated on paper and studied later. But future researchers and the public would be deprived of an important piece of American history if the ship were destroyed or removed and left to deteriorate, which would happen in a few months if left untreated. We could remove the whole hull, but conservation of that much wood would cost an estimated three million dollars. Building a controlled- environment museum to house it in lower Manhattan and supporting continued maintenance would cost many times more.

After consultations among the various parties and with outside consultants from all over the United States and Canada, it was agreed that the bow was such an important treasure it had to be saved. The rest of the ship, after careful study, was to be abandoned. Developer Howard Ronson offered to underwrite the preservation of the bow.



### TRILATERATION

---



### STATION LINES BY POLAR COORDINATES

Figure 5. Measuring systems used on the Ronson ship: trilateration for general provenience data and polar coordinates for recording the shape of the hull. (W. Riess)

When the crew finished studying the ship, a team took the bow and beak apart piece-by-piece in a twenty-four-hour marathon to meet our deadline of March 4. We transported the carefully wrapped timbers to Soil System's conservation laboratory in Groton, Massachusetts. There the timbers were immersed in tanks of water to begin a long conservation process, necessary to allow the timbers to survive eventual drying and exhibition.

Once the timbers were safely in the laboratory we had time to consider the ship we had excavated. In June 1982 we gathered an interdisciplinary team of specialists from around the United States to help extract information from this important find. Smith, in charge of recording the site, made a preliminary study of the hull. Conservators Heidi Miksch, Ken Morris, and Betty Seifert studied the needs of the artifact collection and began to conserve each artifact in the Soil Systems laboratory.<sup>2</sup>

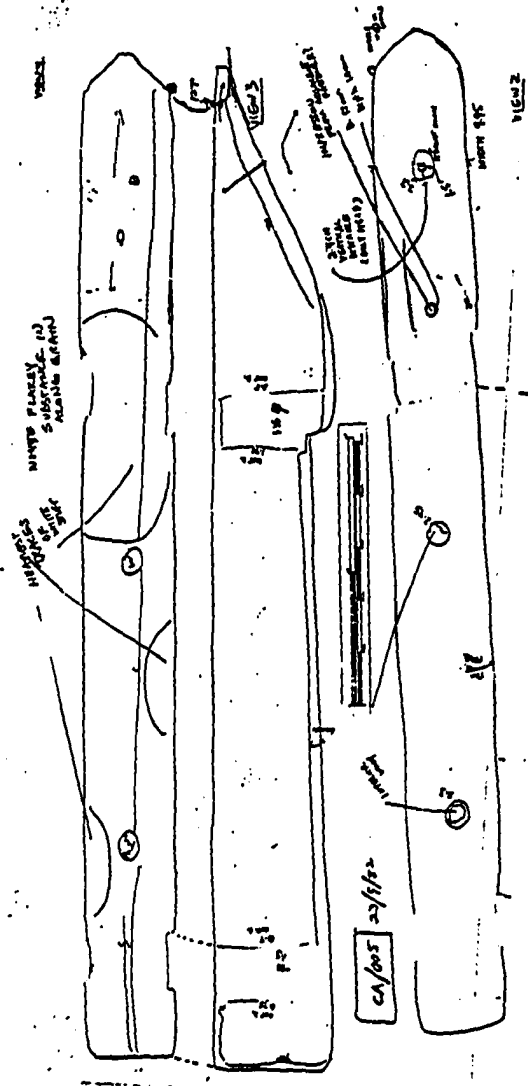
Dr. Richard Jagels, of the University of Maine Forestry Laboratory, began a series of identification, mechanical, and chemical tests on the ship timbers. His chemical analysis allowed the conservators to understand some of the problems they faced in cleaning and preserving the ship timbers. His mechanical strength tests of the wood will allow a better designed reconstruction of the bow, so that it would not sag or break after years of exhibition. His identification of some of the species of wood used on the ship are helpful to historical identification and analysis of the ship.<sup>3</sup>

A careful recording of the bow timbers was necessary for a number of reasons. First, the timbers were easily available for a few months while they were kept in fresh water in the laboratory. Second, though we intended to use the best conservation treatment for water logged wood, the conservation of such material is far from fool-proof. We expect to lose a

few severely deteriorated pieces during the processes. If new pieces were to be made to replace them in the bow when it is exhibited, it would be best to have a good record of the pieces. Third, the best method of reconstructing the bow is to make a scale model of each piece and put them together first, finding mistakes and new information in the process. In order to make the model pieces, one needs good records of the originals. For all these reasons we made a one-to-one tracing of each face of each saved timber.

To make the traces Kerry Horn used a method developed by J. Richard Steffy of Texas A&M University and the Institute of Nautical Archaeology. Horn suspended a large piece of glass over a timber, spread a clear sheet of plastic over the glass, and traced the outline of the timber with indelible felt-tipped pens. Details, such as nail holes, trunnel holes, and grain, were color coded and traced. Parallax was avoided by aligning the reflection of her eye and pen tip in the glass with the pen tip and recorded spot on the timber below. The full sized traces were then photographically reduced to one-to-five, the scale of the model, for the ship reconstructor (See Figure 6).

Jay Rosloff, a graduate student in Nautical Archaeology at Texas A&M University, studied the Ronson ship's bow as his master's thesis project. He constructed a one-to-five model of the bow and conducted historical research in an attempt to identify the nationality of the ship by the shape of the bow and to discover hitherto unknown construction techniques of the early eighteenth century. Although unsuccessful in the identification attempt, Rosloff found that the bow provided some new insights into eighteenth-century shipbuilding.<sup>4</sup>

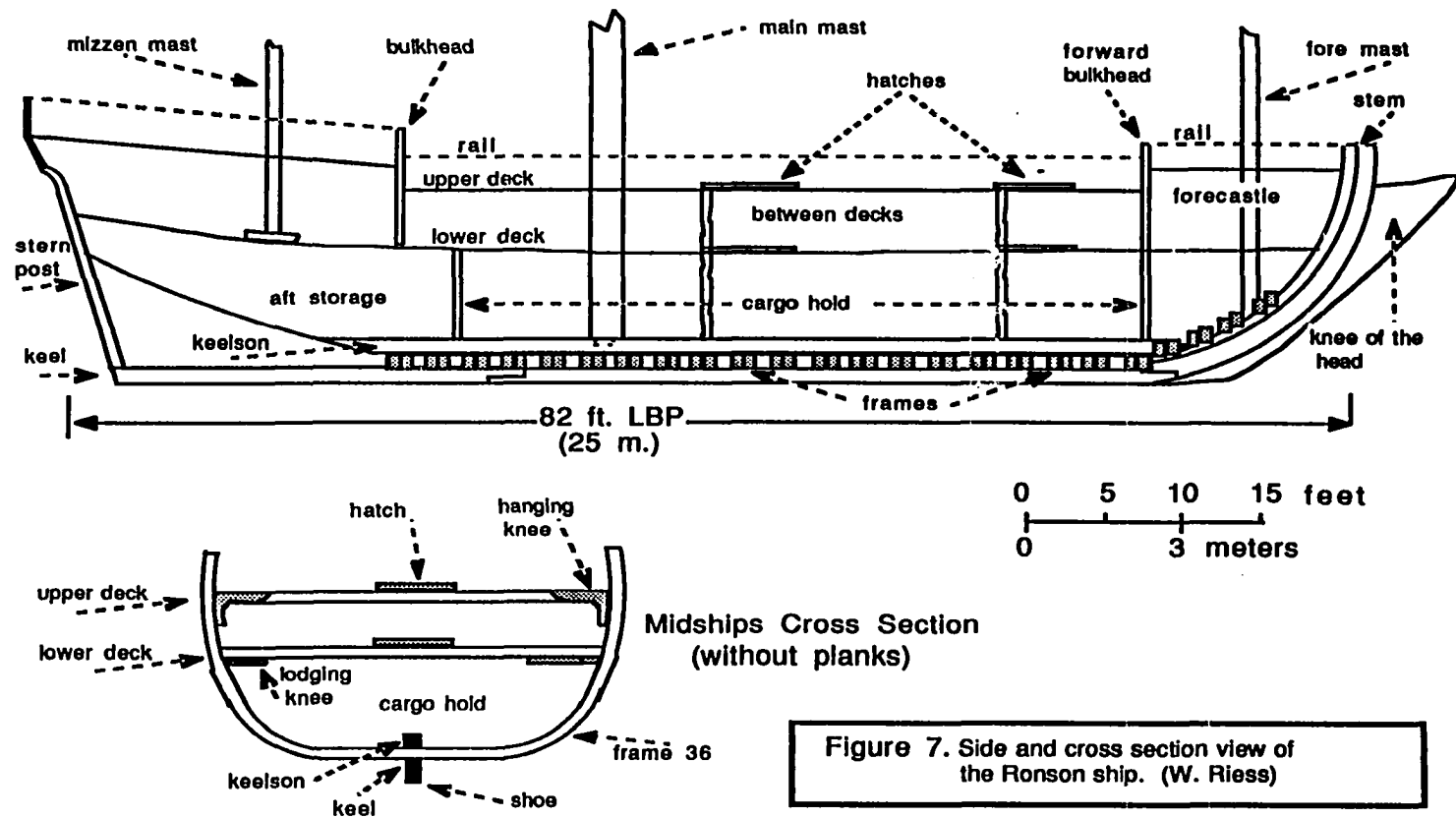


**Figure 6. Full scale (one-to-one) tracings were made of each piece of bow timber before the wood was subjected to intense conservation treatment. (K. Horn)**

By the autumn of 1982, the bow timbers were cleaned, recorded, and ready for chemical conservation treatments. The wood was placed in a bath of two percent hydrochloric acid to remove iron salts without destroying its cellular structure. The wood then went into a solution of water and polyethylene glycol (PEG), a synthetic microcrystalline wax, where it spent two years soaking. The timbers are now at The Mariners' Museum in Newport News, Virginia, where the staff is controlling their drying by lowering the surrounding relative humidity 1% per month and applying more coats of PEG every week. To date, the PEG solution has penetrated approximately 1 inch (2.5 cm.) into the wood, the optimum distance for wood in this condition. When the timbers are eventually dried the PEG will remain in the wood cells, giving them strength to retain their shape. Eventually the timbers will be reconstructed to become again the Ronson ship's bow in an exhibit at The Mariners' Museum.

#### Description of the ship's remains

The Ronson ship was ship-rigged, meaning that she carried three masts with square sails on the foremast and mainmast, a small square sail at the top of the mizzen, and a fore-and-aft lateen rig on the lower mizzen. The exact position of such masts varied somewhat from ship to ship, but the Ronson ship's foremast was stepped farther forward than most ships depicted in contemporary illustrations (See Figure 7). The ship had a fully intact knee of the head (beak) protruding 6 feet (1.8 m.) forward of the stem. She had a moderately full bow, flat floors, and a square tuck stern. Most merchant ships of her size had two major decks, a lower (gun or main) deck just above the waterline, and an upper (weather) deck approximately 5 feet (1.5 m.) above the lower deck. We found this ship extant from the keel up to the lower counter timber in the stern and to approximately 3 feet (0.9 m.) above the lower deck in the bow. While the butt, or lower end, of the mizzenmast remained, the mainmast





and foremast had been removed. Only one section of the upper deck, just aft of the foremast, was found, collapsed onto the remains of the lower deck. Almost all of the lower deck and its support structure remained.

The main cargo hold was extensive. Its maximum dimensions were: 27 feet (8.1 m.) wide, 7.5 feet (2.25 m.) high, and 44 feet (13 m.) long. Tongue-and-groove panelling lined the provisions stowing space behind the mainmast. A bilge pump was located in the hold and internal lower deck scuppers, which directed rain, urine, and splash water from the lower deck to the bilge pumps, were positioned just below three gunports along the port side. Exposed gun ports indicate that the ship had been armed with at least six 6-pounder cannon on the lower deck, and probably additional smaller guns above.

Unfortunately, during the excavation we were only able to touch blindly the top of the keel and briefly glimpse the stern post. However, we did remove the entire stern structure for study, conservation and exhibition. The complete stern structure was not a single piece, but two large curved timbers. The largest stern piece measures 14 feet-2 inches (4.3 m.) from tip to tip. its forward side abutted the knee of the head members. The crescent moon-curve of the stern formed the profile of the bow. Twelve inches (31 cm.) wide at each end, the stern widens to 16 inches (41 cm.) at the center.

The dimensions of the stern and other pieces provide much information about parts of the ship that we never saw. For instance, since we have the greater part of the stern and the samson post we know where the bowsprit entered the hull and where its lower end butted into the ship, though the actual bowsprit was removed some time in the eighteenth century. The dimensions of the main stem scarph reflect the dimensions of the keel we were never able to see. The dimensions of the keel were probably 12 inches (31 cm.) wide by 14 inches

(31 cm.) high where it scarphed to the stem. The top of the stem was approximately 82 feet (24.6 m.) from the top of the stem post. After analyzing the hull remains, we found that we should subtract 10 feet (3 m.) for the curve and cant of the stem and 4 feet (1.2 m.) for the rake of the stem post, to arrive at an approximate keel length of 68 feet (20.4 m.).<sup>5</sup> It is doubtful that a span this long would have been cut from one timber, but how many pieces were scarphed together to make up the keel length we will never know. We did not see the stem post until the ship was being torn apart after we finished our excavations. The rudder we had hoped to find was gone, probably unshipped when the vessel was brought in for cribbing.

Frames (ribs) of the ship were made of a combination of floor timbers and futtocks which were trunneled together and bolted to the keel and keelson (See Figure 8). Average dimensions for the central frames were: molded (inside to outside of the hull) = 8.5 inches (22 cm.), sided (fore-and-aft inside surface) = 8.5 inches (22 cm.) per futtock or 17 inches (43 cm.) per frame, and spacing = 6 inches (15 cm.). These dimensions varied for each frame, especially in the bow and stern. In the bow the frames' sided dimensions reached 19 inches (48 cm.) and there was no space between frames. The futtocks in each frame were trunneled together fore-and-aft, except those farthest forward, where the frames formed a complex group of curved timbers. There were no cant frames in the bow, only square frames (frames perpendicular to the keel) coming approximately halfway up the stem, with the remaining spaces filled with hawse pieces. Between the frames in the central part of the ship, just above the ends of the floor timbers, we found 2-inch (5 cm.)-thick chocks which were flush with the outer planking but stopped 1 inch (2.5 cm.) down from the ceiling planks.

Outer planks for the ship were generally 2-inch (5 cm.) thick and varied in width from

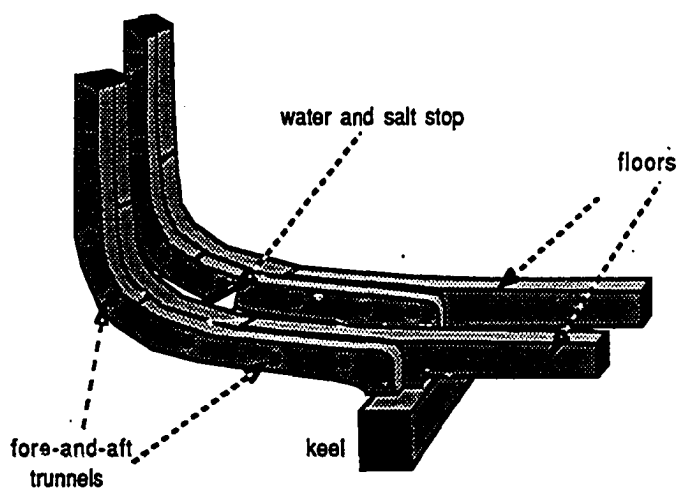
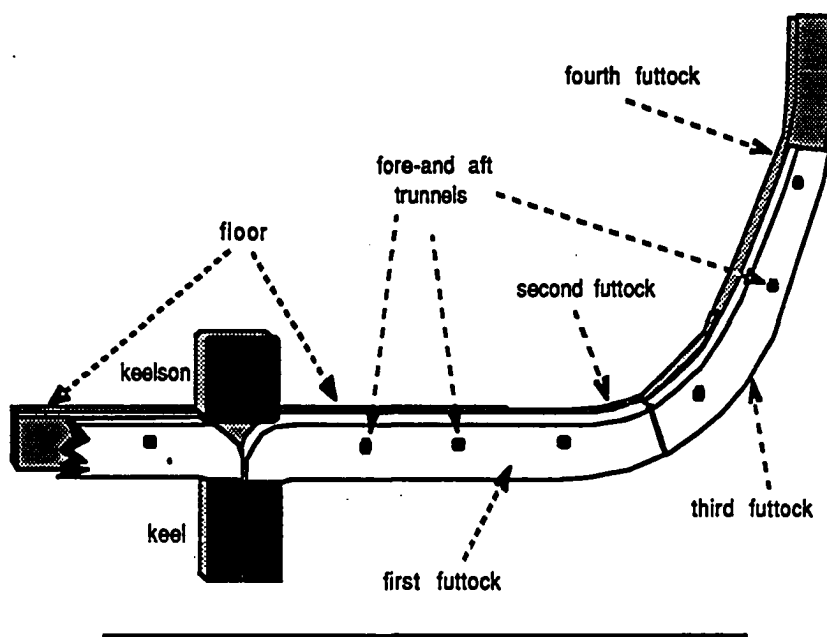


Figure 8. Typical midship area frame construction on the Ronson ship. (W. Riess)

8 to 14 inches (20-36 cm.). Three 4-inch (10 cm.)-thick wales, in a tight belt just above the waterline and below the gunports, girdled the vessel from the stern to the stern tuck. Just above and below the wales, thicker outer planks, varying from 2 1/2 to 3 1/2 inches (6-9 cm), tapered down to the normal 2-inch (5 cm.)-thick planks. Inside the hull and opposite the lower wales, a 3-inch (8 cm.)-thick clamp/shelf and waterway were bolted through the hull. A few feet below them, just inside the turn of the bilge, were three 4-inch (10 cm.)-thick foot wales. The remainder of the inner surface was covered with 2-inch (5 cm.)-thick ceiling planks, including flat-lying limber boards with finger holes carved into one end of each board.

The Ronson ship had three breast hooks, internal structural timbers which tied both sides of the ship together at the bow. The lowest hook was the smallest, made from a single large timber. The second breast hook, or deck shelf, was made from three timbers and bolted just under the main deck. A shelf was cut into its upper surface to support the deck. Another large breast hook, made from a single timber, was bolted above the deck. A fourth timber, probably a deck shelf, was approximately 4 feet (1.2 m.) above the other shelf.

We found two decks on the Ronson ship: the collapsed lower deck in the forward two-thirds of the ship, and the collapsed upper deck between the main and forward hatches. Unfortunately, the other sections of decking were removed during the initial filling period. However, many of the upper deck beams and the deck support structure for the entire lower deck were still intact (See Figure 9).

Twelve-inch (30 cm.)-square, slightly crowned deck beams spanned the breadth of the ship and dovetailed into clamps along the hull's side. The upper deck beams were braced from their fore or aft sides with hanging knees, which were bolted to the hull through the

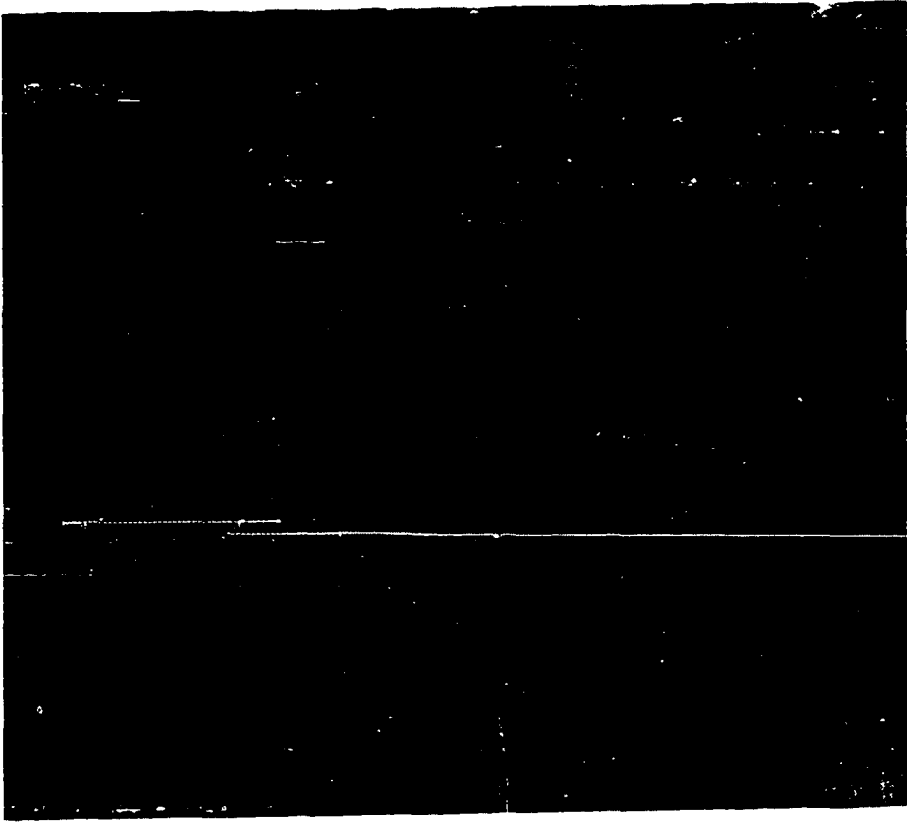


Figure 9. The collapsed lower deck of the center, port side, looking aft in lots 32 and 33.  
(W. Riess)

ceiling planks. Aft of amidships the hanging knees were on the forward side of the deck beams. Forward of amidships the knees were on the aft side of the beams. The lower deck beams were supported by lodging knees, which were bolted to the hull and the adjoining deck beam. Each knee's fore-and-aft leg was cut short to butt against the next deck beam, forming a continuous band of thick timber inside the hull at the height of the deck beams and the lower wale belt. In the same manner as the hanging knees, the lodging knees aft of amidships adjoined the deck beams on the forward side, and forward of amidships on the after side.

To either side of the ship's centerline, 12-inch (30 cm.)-wide by 3-inch (8 cm.) thick carlings ran fore-and-aft and butted into slots cut in the deck beams. Running between and parallel to the full deck beams were ledges (intermediate deck beams). These were the same width and thickness as the carlings and spanned the short distances between the lodging knees and carlings. Only in two instances, because of other structural needs, did the sequence of full deck beam, ledges, and fore-and-aft carling vary.

The decks were made of 1.5-inch (4 cm.) planks, except for the nibbing stake (outermost deck plank), which was 2 inches (5 cm.) thick. Between the nibbing stake and the sides of the ship was a waterway, designed to keep water on the deck from entering into the bulwarks (sides) of the hull. On the Ronson ship the waterways were 6 inches (15 cm.) wide by 4 inches (10 cm.) thick at the bulwark. The waterways tapered down to meet the 2 inches (5 cm.) thick side of the nibbing stake. There were two hatches on the lower deck. The main hatch was just forward of the mainmast and was 6 feet (1.8 m.) long by 5 feet (1.5 m.) wide. The forward hatch was 5 feet (1.5 m.) long by 4 feet (1.2 m.) wide. On the after side of the main hatch stood a tall carved monkey post, which is a stanchion notched to serve as a ladder. Mortised into the keelson

and notched into the deck beam, the post extended up through both decks. Another monkey post stood on the after side of the forward hatch, but we were not able to excavate it fully.

Although there were three masts on the Ronson ship, we found only the foremast and mainmast partners (heavy support timbers in the deck) because of previous demolition of the deck in the stern. There were three openings in the mainmast partners. The largest was for the mast, while two smaller holes held the bilge pumps stepped behind the mast on either side. We recovered the octagonal butt of the mizzen and the butt of the port bilge pump.

Below the lower deck we found remnants of a bulkhead 10 feet (3 m.) aft of the stem and indications of another bulkhead 8 feet (2.4 m.) aft of the mainmast. We found no evidence of bulkheads in the 44-foot (13 m.)-long central cargo hold, but a few nail holes on the lower deck suggest partitioning between decks in the amidships area. The partitioning separated the interior of the hull into at least three large compartments: a bow storage space, which may have held the boatswain's supplies, a main hold for the cargo, and an aft storage space for provisions and munitions. Paneling over the ceiling planking in the aft storage compartment was probably added to keep the ordnance powder dry.

During the excavation and analysis of the ship timbers, we noted the care with which the ship's builders had conducted the heavy construction. Unlike the other two eighteenth-century American-built vessels which have been excavated, the Revolutionary War privateer *Defence* and the Brown's Ferry boat, we found no indications of any labor-saving shortcuts taken.<sup>6</sup>

While the artifacts and bow timbers were being conserved, I turned my attention to the analysis and interpretation of this site. With careful study, we might be able to answer some important questions in American colonial history. We hoped that the archaeological evidence would be at least complementary to the limited archival data available for the period. By combining historical and archaeological evidence about the life of the ship, from its conception in the designer's head through its construction, sailing, and burial in New York, our understanding of colonial maritime history might become clearer.



## NOTES, CHAPTER 1

1. Warren Riess, "The Phantom Pyramid, a Trilateration Measuring System" (unpublished paper presented at the Conference For Underwater Archaeology, 1983).
2. Sheli O. Smith, "The Ronson Ship: The Ship," *Proceedings of the Society for Historical Archaeology*, 1987, to be published. Betty Seifert *et al.*, "Conservation of the Ronson Ship's Bow," *Waterlogged Wood: Study and Conservation* (Grenoble, 1984), 269-297.
3. Seifert *et al.*, "Conservation," *Waterlogged Wood* (1984). Richard Jagels, "Anatomical, Mechanical, and Chemical Analysis of the Ronson Ship Timber," *Proceedings of the Society for Historical Archaeology*, 1987, to be published.
4. Jay Rosloff, "The Water Street Ship: Preliminary Analysis of an Eighteenth-Century Merchant Ship's Bow" (M.S. thesis, Texas A&M University, 1986).
5. This is an estimated ratio of length of deck-to-length of keel based on figures for larger ships in William Sutherland, *The Shipbuilder's Assistant* (London, 1726), 90-103.
6. J. Richard Steffy, "Construction Details of the Brown's Ferry Ship," *Proceedings of the 9th Conference on Underwater Archaeology* (Austin, Texas, 1978), 55-61. Warren Riess, personal observations of the *Defence*. David B. Wyman, "Understanding the Structure of the Privateer *Defence*," *Proceedings of the 13th Conference on Underwater Archaeology* (San Marino, Calif., 1982), 70.

## Chapter Two      Identifying the Ship

The Ronson ship was the largest object used for fill in the block. One might assume that the use of the ship would have been newsworthy, and that the event of placing the hull in position would have been recorded in local newspapers, city records, and private financial records. The name of the ship might even be remembered in local lore. However, the identity of the Ronson ship was not immediately available from the historical data about the 175 Water Street block, possibly because the use of derelict ships for cribbing was too common in the eighteenth century. Without knowing the name and history of the ship, one might interpret the archaeological data in terms of a generic merchant ship of the time, but by narrowing the vessel's identity one might be able to construct a more accurate microhistory within the eighteenth century. Therefore, research was needed to determine the name of the vessel or at least its origin and use.

Four methods were used to try to identify the ship: a consideration of the morphology of the ship's structure, a biological analysis of the timber and teredos (ship worms) left in the wood, an archaeological analysis of the artifacts and fill found in the hull, and an investigation of available records. Some of the methodology is only within the ken of professional experts in other disciplines, such as naval architects and wood and teredo biologists. Their work has helped guide traditional historical and archaeological research. I decided to conduct all four exercises because of the relative obscurity of the ship's identity and the synergistic effect of gathering data through four disciplines. Information from each method has provided both direction for research in the other three methods and the

elimination of certain possibilities which might otherwise have led the research down tedious dead end paths.

### Morphology of the ship

Morphological research involves the determination of a subject's shape and size and a comparison of such characteristics with those of other, identified, subjects. In the case of the Ronson ship we might use for such comparison the general shape and size of the hull, the presence, position, and size of certain features and hardware, and the specific dimensions of certain timbers to determine the measuring system used by the builders. These characteristics might help determine the nationality of the builders, the intended use of the ship when she was built, and the intended geographic areas to which she would be sailing.

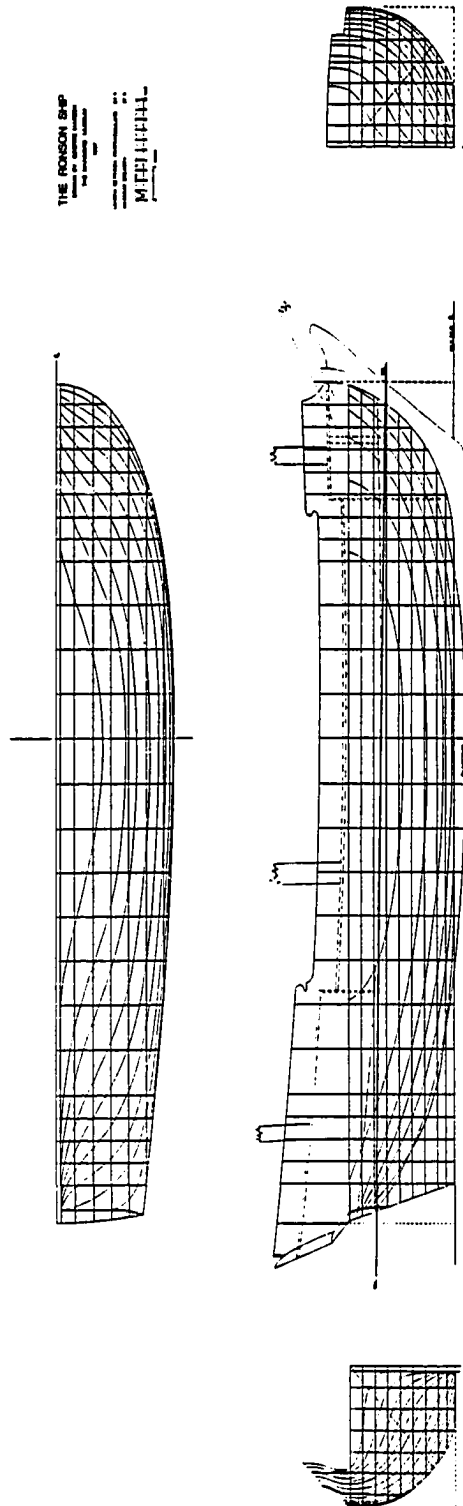
The ship that lay in the mud at 175 Water Street in 1982 was far different from the vessel that was launched sometime in the early eighteenth century. Evidence of eighteenth-century damage and repairs to the interior of the hull and teredo damage to some hull timbers indicate that the vessel served a long life as a sailing ship. Years at sea tend to change the shape of a ship, as its hull hogs (bow and stern sag). In addition, the vessel's sides might have splayed a little during more than 250 years of burial beneath 21 feet (6.4 m.) of fill and nineteenth-century commercial buildings.

To compare the shape and form of the hull to others from the same century I had to determine the ship's original shape. A team of four volunteers at The Mariners' Museum helped analyze the field data to draw the ship as we found it, adjusted obvious changes such as collapsed decks, and faired the lines of the hull.<sup>1</sup> "Fairing" is a graphic process by which one repeatedly tests various slight adjustments to the hull shape until all the data fits in proof of the shape. When construction details were added, a close approximation of the

original ship was determined. (See Figure 10).

When launched, the Ronson ship was 82 feet (25 m.) long between perpendiculars (measured from the inside top of the stem to the inside top of the stern post), or approximately 100 feet (30 m.) overall, with a keel approximately 68 feet (21 m.) long. She had a maximum breadth of 27 feet (8.2 m.), a 7.5 foot (2.3 m.) deep cargo hold, and drew approximately 11 feet (3.4 m.) of water when fully loaded. According to the contemporary formula of "length of keel x maximum breadth x 1/2 maximum breadth + 94 = tonnage," the ship would have had a measured tonnage of 260 tons and would have been registered in England at between 220 and 300 tons.<sup>2</sup> Because of differences between English and colonial practices, an American merchantman of her dimensions would have been registered at one of the colonial ports at two-thirds that of the English figure, or between 150 and 200 tons.<sup>3</sup>

The overall shape and size of the Ronson ship indicates that it was a large merchantman from the early eighteenth century, though not as large as the great East Indiamen, which were typically registered at 600 tons. There is much morphological evidence that identifies the vessel as a merchant ship, rather than a warship. A warship of this size would have had more than three gunports on the lower deck; in fact, the lower deck would have been the "gun deck." The gun ports on a warship in the eighteenth century would have been designed for guns larger than 6-pounders and more knees would have supported the deck beams to carry the weight of many heavier guns. The Ronson ship, like most merchantmen, had a complete run of caulked ceiling planks to protect its cargo from seawater which might work through the hull in heavy weather. The hawse holes, which let the anchor cables into the bow, were above the upper deck, rather than between the decks as on a warship. In addition, the Ronson ship had a windlass, a feature of eighteenth-century merchantmen, but not of warships of the period.<sup>4</sup> In the areas of the ship which were extant in 1982, most other differences



**FIGURE 10. Lines of the Ronson Ship. (G. Matson)**

between a merchant and war ship would have involved the ship's hardware and cargo, which had been stripped from the ship before it was buried.

Merchantmen were generally classified by their hull type rather than their sail and mast configuration in the eighteenth century. In 1768 Fredrik Chapman, one of the leading shipwrights of his time, published *Architectura Navalis Mercatoria*, a treatise on design.<sup>5</sup> Based on many drawings of various vessel types in Chapman's work, David MacGregor, in his *Merchant Sailing Ships, 1775-1815*, constructed a modern table of points of identification for the six major ship classes (See Table I).<sup>6</sup>

MacGregor's table does not include many exceptions in Chapman's publication, but is still quite useful in determining the probable contemporary class of the Ronson ship. Using MacGregor's terms, we find that the Ronson ship had a length between perpendiculars (LBP) of 82 British feet, a full [knee of the] head and cheeks in the bow, a square tucked stern with wales running aft to the wing transom, a small deadrise (angle off horizontal of the floor timbers) in the midship area, relatively hard bilges (quickness of change from horizontal to vertical), slightly rounded sides, a moderately fine entrance at the bow, and a full run. In addition, the Ronson ship remains suggest the former presence of rails and a figurehead in the bow and a quarter gallery in the stern, though none of these structural features survive. The Ronson ship therefore fits the description of a frigate, except for its midship area, which is more like that of a bark in the table.

TABLE I  
 MACGREGOR'S IDENTIFICATION OF SHIP TYPES FROM PLANS IN  
 CHAPMAN'S *ARCHITECTURA NAVALIS MERCATORIA*

Class	Max Size	Bows	Stern	Mid-section	Waterlines in half-breadth plan
FRIGATE	160.0 41.5 1275. B	full head, cheeks, rails, fig'head	square tuck, quarter gal- leries, wales go to wing transom or tuck	deadrise varies from small to big, slack bilges, round sides	moderately fine entrance and run
BARK	150.9 38.0 1250. B	plain stem, no head	square tuck, wales go to wing transom or tuck	flat floors, hard bilges, vertical sides	full entrance and run
FLUTE (Flyboat)	128.3 29.7 700. B	plain stem, no head	round stern, square taffrail wales go to sternpost, out- side rudder	small dead- rise, slack tumblehome all around	full entrance parallel sides, finer run
PINK	109.2 29.6 434. B	full head, cheeks, rails, fig'head	round stern, square taffrail or narrow lute, wales go to sternpost	hollow gar- boards, big deadrise, slack bilges, round sides	fine entrance and run
CAT	151.9 37.6 1120. B	plain stem, no head	round stern, square taffrail, wales go to sternpost, narrow stern	small deadrise, vertical sides	full entrance, finer run
HAGBOAT	156.2 38.11 1159. B	full head, cheeks, rails fig'head	round stern, square taffrail, quarter galleries, wales go to sternpost	small dead- rise, vertical sides	moderately fine entrance and run

From: David R. MacGregor, *Merchant Sailing Ships 1775-1815: Their Design and Construction* (Watford, England, 1980), 20.

This is not inconsistent in reality, for MacGregor shows the rule and acknowledges exceptions within Chapman.<sup>7</sup> The relatively flat floors and hard bilges of the Ronson ship would give it a shallower draft per ton than a typical frigate shown in Chapman's treatise.

Though the term "frigate" refers only to a warship today, in the eighteenth century it also referred to a class of merchant ships. They were sturdy transoceanic ships which could be heavily armed to sail into troubled waters. They were generally good sailing vessels and, since they required more men than other vessels to work the guns, frigates could carry more sail than other merchant ships. For their length and breadth they were not the most spacious of cargo vessels, and therefore their efficiency, both in cargo capacity and numbers of crew per ton, was lower than ships that sailed with less protection aboard.<sup>8</sup> The Ronson ship's shallow draft, would have reduced her cargo capacity still more. The decreased cargo capacity and increased crew would have meant a relatively high cost per unit of cargo transported. Therefore we might infer from its size and general shape that the Ronson ship was designed to carry an expensive or important cargo to or from shallow waters, along a route where trouble could be expected.

Since frigates were built along similar lines in most of the northern European countries and some of their colonies, it is difficult to determine the nationality of a frigate by considering its general shape. Shipwrights and shipbuilding ideas moved from one country to another, and ships of the same size built in the same shipyard varied in shape depending on their intended use, their owners' idea of a good ship, and the sailing qualities of the last ship built there. In northern Europe, shallow draft ships were most common in Holland, where the ships had to navigate shifting sand bars to use their ports, but other areas of the world, such as the northern coal ports of England and the Chesapeake Bay in America, also used shallow draft ships.<sup>9</sup>



To find ships with similar shapes I inspected the Fredrik Chapman ship draft collection. Chapman followed his father's trade by apprenticing to the Swedish Navy Dockyard in 1738. By his retirement in 1793, he had worked in England, France, Holland, and Sweden, eventually becoming the Vice Admiral in charge of Swedish naval shipbuilding. During his lifetime he collected his own and others' drafts of ships and small craft of the Western world.<sup>10</sup>

No ship in Chapman's collection stands out as being most like the Ronson ship, but three ships come close. Although shorter in length and smaller in draft, the Ronson ship had the general appearance of Chapman's English West Indies trader. Below the water line the Ronson ship had flatter floors and a harder turn of the bilge than the English ship. The floors and turn of the bilge were more like those of the French and Dutch flyboats, which were designed for carrying maximum cargo in shallow friendly waters. However, the stern of the Ronson ship was typically British, rather than French or Dutch. The shape of the Ronson ship, therefore, suggests an English West Indies trader which was adjusted to carry more cargo into shallow waters.<sup>11</sup>

Identifying the origin of the Ronson ship by a comparison of construction details is difficult, because, again, there are only a few examples of detailed ship plans for the period and as far as we can determine from the extant archival and archaeological data, construction traditions were not necessarily location-specific. For example, the frame pattern on the Ronson ship appears to be consistent with the extant plans from various countries. The Ronson ship scarfs (end-to-end intersections of longitudinal strakes) were simple diagonal joints, three times as long as the timbers' widths (See Figure 11). Diagonal scarfs of these dimensions appear to be common to many ship building traditions.<sup>12</sup>

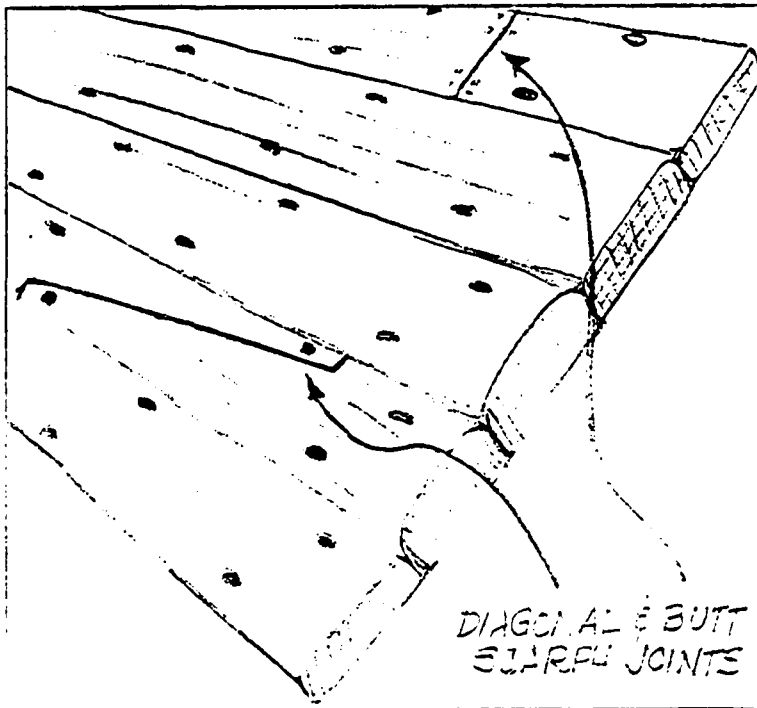


Figure 11. Wales on the Ronson ship were joined with diagonal scarphs, while planks generally had butt joints. (S. Smith)

Along the outside of the lower deck, the waterways were a distinctive shape throughout the length of the ship (See Figure 12). The waterways were horizontal planks, 3 in. ( m.) thick by 6 in. ( m.) wide which served as both an outer deck plank and a ceiling plank at the intersection of the deck and ceiling. Their shape was similar to those on the 74-gun HMS *Bellona*, launched in Chatham, England in 1760, and the Dutch East Indiaman *Noordt Nieuw Landt*, built in Rotterdam in 1750.<sup>13</sup> Two French examples from the eighteenth century show a distinctively different style of waterway, which forms a 45-degree angle at the intersection of deck and ceiling.<sup>14</sup> These examples, however, are slim evidence to support any hypothesis about the Ronson ship's origin, especially since only one of the five was a merchantman.

Measuring systems were standardized within each country, or empire, only in the eighteenth century. If we could determine the system used on the Ronson ship, the country of origin might be obvious. During the archaeological excavation in 1982 measurements were taken in the English system to one quarter of an inch (2.5 cm.). To determine the original measuring system I considered using an arbitrary system, different from any of the supposed possibilities – namely the metric system – to measure again a number of timbers. Then I would seek a common denominator for the measurements and compare that common denominator to the known eighteenth-century scales to see if one matched.

But one must be careful which measurements to take for the study. Finishing ship timbers and overall dimensions to within an inch (2.5 cm.) on the ship may not have been important. For example, the draft marks on the Ronson ship's stem, which allowed the master to know how deep the ship sat in the water, were approximately 1 foot (0.3 m.)

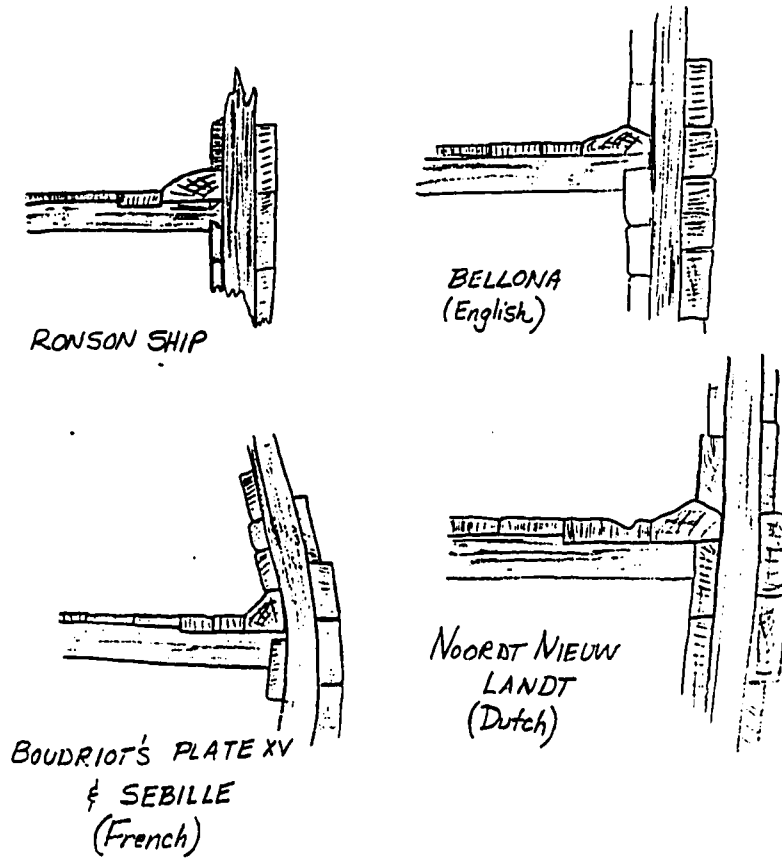


Figure 12. Cross sections of waterways on the Ronson ship, HMS *Bellona* (1760), *Noordt Nieuw Landt* (1750), and standard French warships (c.1800). (S. Smith)

apart, but the distances between marks varied from 10 1/4 to 13 1/4 inches (26.0 to 33.7 cm.).<sup>15</sup> The distance between deck beams varied from 37 inches to 53 inches (94 to 135 cm.). There are two places on the ship where one might expect the shipwright took care to fashion pieces precisely in order to have two pieces fit together properly: the dove tails where the deck beams fastened to the shelf clamp on the side of the ship and the hatch coaming on which the cargo hatches rested. Unfortunately the hatch coamings were measured carefully in the English system in the field and then, due to time constraints on the site, the coamings were discarded. They can not be used for the study. Each of the existing dovetail joints is a slightly different size and shape, with adz marks on the surface. It therefore appears that the open side of the dovetails in the shelf clamps were carved with an adz to an approximate size and shape and their counterparts on the deck beams were individually carved to match them, evidently without being measured with a rule.

Evidence of the builder's measuring system came by surprise when George Matson, Sheli Smith, and I studied the design technique used by the ship's architect, as discussed in Chapter Four. We discovered that the stem rabbit, a groove which accepted the forward end of outer planks, described an arc whose radius was 16 feet 0 inches in the English system (4.8 m.). Perpendicular to the stem, the outside edge of the only breast hook made of one timber described an arc whose radius was 8 feet 0 inches in the English system (2.4 m.). Both radii were precise to 1/8 inch (0.3 cm.). At first I thought that these two figures indicated that the ship was built in Britain or one of Britain's colonies, but the two radii are also divisible by the eighteenth-century French and Antwerp foot. The two radii equalled exactly 15 feet 0 inches and 7 feet 6 inches respectively in France and 17 feet 0 inches and 8 feet 6 inches in Antwerp.<sup>16</sup>

Other information about the ship's remains indicate that she was abandoned because of

age, rather than accidental damage. No charred timbers, or other indications, suggest that the Ronson ship was even partially burned. The remains did have evidence of a number of repairs. The foremast step and amidships waterway had been split and repaired. The number of nail holes in the outer planking indicate that the 1-inch (2.5 cm.) thick outer sheathing, usually replaced every two to four years, had been replaced once. Probably because of damage to the sheathing, ship worms had found their way through the sheathing, horsehair, and pitch to damage some of the outer planking and the stem itself. Damage to the planking had been caulked and recovered with pitch and sheathing. The sheathing evidence indicates that the ship served for four to eight years before being either abandoned or used as a moored hulk. If used as a storage hulk, like some of the ships in the 1717 Burgis view of New York, she may have remained afloat for a number of years before being placed parallel to the shore to bulk fill (See Figure 13).

#### Artifact Analysis

Although only a few of the artifacts found in the ship are considered to be associated with the ship during her sailing life, an analysis of all the artifacts might help determine the ship's identity. Artifacts found in the bottom of the hull, and in fairly inaccessible areas of the hull, may be associated with the vessel's life and may point to origins and uses of the ship. A study of the fill, placed in the hull when it was positioned to crib fill in New York, may allow us to date the burying of the hull, and therefore allow us to focus our archival research on a particular time slot.

Unfortunately, most of the artifacts that were probably associated with the ship's life are not definitely assignable to a country or time period, within a few decades. Two wooden buckets, a leather armlet and protective mask and a nautical block are all types which have



Figure 13. A stripped ship, probably being used as a storage hulk in the stone dock of Manhattan. From "The Burgis View", 1717, plate 34 in I.N. Stokes, *The Iconography of Manhattan Island, 1498-1909* (New York, 1928).

been found in context with sites from many countries in the mid-eighteenth century.<sup>17</sup> An intact spirits bottle, found in the stern under the cabin, may relate to the life of the ship. It is associated with English sites from 1720 to 1757.<sup>18</sup> Clay pipe sherds found in the lowest layer within the ship, which therefore may be associated with the original ballast of the ship, were made in western England and date from approximately 1720.<sup>19</sup> Whereas single English bottles are often found on archaeological sites from other countries, the exclusively English style of clay pipe sherds suggests that this was an English ship.

Artifacts from the remaining layers of fill in the hull, evidently placed there with other ships' ballast or dirt from land, vary in their origin, but were mostly made in Britain or America. Only two artifacts have dates on them, a lead balance beam scale weight with the year 1746 scratched in it and a ceramic jug with 1747 molded into its neck. The other approximately 5,000 artifacts have date ranges from 1670 to 1770, but most were in use in the 1740s. Although the artifacts cannot identify the origin of the ship, their typology indicates that the ship was buried in the late 1740s or 1750s, probably the late 1740s. If it had been buried before 1747 some of the artifacts, especially the weight and ceramic jug, would not have been found in the hull. If it was filled after the 1750s the upper date range (terminus anti quem) of the artifacts should have been higher.

### Biological Analysis

Biological analysis of the ship's remains is another method of determining the vessel's origin, intended use, and the actual geographic areas sailed. Although eighteenth-century shipwrights moved some timber great distances before shaping them to form part of a ship, the identification of the exact species of woods used on the Ronson ship might indicate the area in which she was built. Certain species of wood were also preferred for specific uses of vessels, such as the pine planking of a "pinnacle." In addition, a determination of the species



of teredos in the hull's sheathing might indicate to what geographic areas the ship sailed.

To determine the species of wood used on the Ronson ship we sent samples of various timbers to three laboratories: the Center for Wood Anatomy Research, United States Forest Products Laboratory; the Forest Products Laboratory, University of Maine; and the Department of Forest Products, Virginia Polytechnic Institute. All three laboratories concluded that because the wood was so degraded, the determination of exact species in most cases would be impossible, but that some information could be extracted. The results of their comparative analysis is shown in Table II.

Table II includes many empty spaces because each laboratory was given only a limited number of wood samples, with only some samples coming from the same timber. Also, the United States Forest Products Laboratory was sent samples of different tunnels than the tunnels sent to the University of Maine laboratory. Therefore each has identified different woods for the tunnels.

In general the main structural timbers, outer planking, and ceiling planking of the ship were made from trees of the white oak group, possibly live oak. White oaks (*Quercus*) were found in many areas of the world, including most coastal areas of North America and northern Europe, but live oak (*Quercus virginiana*) was found only in the coastal plains of North America, from Virginia to northern Mexico. Live oak is an exceedingly strong and heavy wood which is rot resistant and generally is found in a variety of natural curves, making it very useful for shipbuilding.<sup>20</sup> It was used for making ships at least by the 1740s in southern North America and was shipped as material to other shipbuilding areas as early as 1775.

TABLE II WOOD IDENTIFICATION ON THE RONSON SHIP

<u>TIMBER</u>	<u>IDENTIFICATION BY TESTING INSTITUTION</u>		
	<u>U.S. FOREST PROD.</u>	<u>U. OF MAINE</u>	<u>VIRG. TECH.</u>
Keelson	White Oak		
Stem			prob. Live Oak
Frames	White Oak	pos. Live Oak	
Lodging Knee	White Oak	Oak*	
Outer Planks	White Oak	pos. Live Oak	
Ceiling Planks	White Oak	pos. Live Oak	
Decking		Southern Hard Pine Red or Scots Pine	
Waterway		Oak*	
Trunnels	1- Hickory 1- Juniper 1- Ash	55- pos. Live Oak 2- White Pine 1- Southern Hard Pine	
Mizzen Mast			prob. White Pine
Capstan			Elm
Bilge Pump			prob. South. Hard Pine

- Notes:
1. Live oak is a species of white oak.
  2. Degrees of identification, in order of certainty:  
 Stated genus = positive identification,  
 "prob." = probable, but not positive,  
 "pos." = possible, some evidence suggests this identification.  
 \* Further identification was not possible.

In the nineteenth century, shipwrights from New England often sent teams of men south in the winter to acquire a load of live oak for their New England shipyards.<sup>21</sup>

Southern yellow or hard pine was probably used for most of the decking, the extant bilge pump, and at least one of the trunnels. Which species of southern yellow pine were used is not discernible, because there are ten species of southern yellow pine which are difficult to distinguish from each other when only decomposed wood samples are available. Their natural range is from Connecticut to Texas, but they are most plentiful from Virginia to Texas.<sup>22</sup> At least one plank of the deck was made of red pine (*Pinus resinosa*) or scotch pine (*Pinus sylvestris*). The former is a North American wood which had a natural range from Canada to Maryland, while the latter is from the British Isles. Unfortunately, they can not be distinguished from each other when the wood is degraded.

When we cut the nibbing strake during excavation we noted that the sawdust was pink and a distinctive cedar smell arose. We concluded that the nibbing strake was made of juniper, or red cedar (*Juniperus* sp.), but no samples were sent to a laboratory for microscopic identification. Juniper is resistant to rot, making it a good wood for a nibbing strake, on which rain water might collect. Several species of juniper are found from Maine to Texas.<sup>23</sup>

A sample of sixty-one trunnels were sent for identification. Of these, fifty-five were oak (possibly a mixture of various species of oak), two were eastern white pine (*Pinus strobus*), and there was one trunnel each of southern yellow pine, ash (*Fraxinus* sp.), hickory (*Carya* sp.), and juniper (*Juniperus* sp.). Although ash, hickory, yellow pine, and juniper might be suitable substitutes for oak trunnels, white pine would seem to be too weak to hold the ship together. The white pine, or all of the non-oak, trunnels may have

been expedient replacements for loose trunnels during a voyage. Species of ash are found in both America and Europe, but hickory is native only to North America.

The mizzen mast was made of white pine, a North American wood prized for its outstanding usefulness for ship masts and spars. The capstan's main spindle, which appears to have been added to the ship after its sailing days, was made of elm, a hardwood found on both sides of the Atlantic Ocean. The capstan's whelps (brackets around which the rope was wound) were made of oak (*Quercus* sp.).

Few conclusions can be reached from the botanical information alone. The wood's degraded state makes it impossible to distinguish exactly which species were used for the main timbers of the ship, though many "probable" and "possible" identifications suggest, but do not prove, that the ship was made of American woods. If the "possible" identifications are accurate, the Ronson ship was built mostly of live oak, with decks mainly of southern yellow pine. Live oak is limited to the Southern Coastal Plain of America, and there is no information that indicates that large amounts of live oak were transported out of the area for shipbuilding in the early eighteenth century.<sup>24</sup> Therefore the botanical evidence suggests, but does not prove, that the Ronson ship was built in the southern North American colonies – Virginia, North Carolina, or South Carolina.

Another biological investigation was made on the teredo (shipworm) remains found in the outer sheathing of the hull. Teredos are bivalves which invade wood during their free-swimming larval period. A larva makes only a small hole when it enters the wood and the opening remains quite small thereafter, even while the animal enlarges its tunnel as it grows. Thus, when it dies, calcium based parts of the shipworm remain trapped inside the tunnel. These remains can be used to identify the species of teredo even when the animal has

been dead for more than 250 years.<sup>25</sup>

In 1982 Dr. Ruth Turner, a biologist at the Museum of Comparative Zoology at Harvard, identified the shipworms in a sample of the Ronson ship's outer sheathing. She found three species: *Teredo mindanensis*, *Bankia carinata*, and *Bankia campanullata*. Today, *teredo mindanensis* is primarily found in the Pacific Islands, Southeast Asia, Indonesia, New Guinea, and the Philippines.<sup>26</sup> *Bankia carinata* is found in tropical waters around the world, but primarily from the Mediterranean to the Caribbean.<sup>27</sup> *Bankia campanullata* is found on the east coast of South America and throughout the Indian Ocean.<sup>28</sup>

Shipworms typically spawn in warm waters and swim in their larval stage to seek wood to enter. Most teredos in an area will spawn at the same time, once each year during the summer. Each species tends to compete better in different circumstances of water temperature, salinity, available wood species, and other factors. The Ronson ship need not have visited any of the above places to have picked up these three species of shipworms. If another ship picked up *teredo mindanensis* in the Philippines and was riding at anchor in Barbados during spawning time for the species, the teredo larvae could seek out the nearest dead wood and enter it. That wood could be the sheathing of another ship at anchor nearby. This scenario was quite possible during the eighteenth century because during peace and war merchantmen and warships from British, Spanish, Dutch, and French empires often called on the same ports as naval vessels, merchantmen, or prizes of war.<sup>29</sup>

Thus the Ronson ship could have picked up all three species in one port at the same time, from other ships anchored near it. Since the outer sheathing typically was replaced every three years, the event would have taken place in its last three years of sailing. The three species of shipworms spawn only in warm waters, not in northern ports like New York or

the British Isles. Thus a zoological investigation of the ship's parasitic teredos suggests that the Ronson ship was in a warm water port during her last years under sail. The fact that no species of teredo was found which is natural to Chesapeake waters, does not eliminate this ship from having been built or sailed in the Chesapeake. It only means that the ship was not in the saline areas of the Chesapeake when the teredos were spawning in the Bay.

### Archival Research

Combining the morphological, archaeological, and biological evidence provides some direction for historical research of the Ronson ship. Measurements on the stem and breasthook indicate that the ship was built to the eighteenth century foot from Antwerp, Britain, or France. Her shape, especially that of the stern, and size indicate that she was an ocean sailing British merchant frigate, designed to carry important cargoes in shallow waters where danger was expected. The three biological studies of her timbers strongly suggest, but do not prove, that the ship was built in Virginia or the Carolinas. Evidence of repairs and maintenance imply that the ship was in a warm water port during the last three years of her sailing career. Finally, analysis of the artifacts from within the hull suggests that the ship was buried between 1747 and 1760.<sup>30</sup>

The position of the ship in the 175 Water Street block also provided some clues for further research. The hull lay roughly parallel to the eighteenth-century shoreline, in street lots 30 through 35, where the water was approximately eight feet (2.4 m.) deep at high tide, judging from the present depth of the river sediment we encountered on the site. An inspection of information about the owners of the water lots might shed light on the identification of the ship. Amy Friedlander's history of the block, completed before the ship was discovered, identified the original owners. They were each granted a water lot, approximately 25 feet (8 m.) wide and 200 feet (60 m.) long, over shallow subtidal river

bottom. The grants were made between 1736 and 1738 and the grantees were required to fill their respective lots by 1756, reserving a 45 foot (13.7 m.) width at the waterfront for a quay. Unfortunately, there is no mention in surviving records of a ship placed in the water lots.<sup>31</sup>

Not finding evidence of the ship in the water lot owners' records, I began a study of New York records in the mid-eighteenth century, a determination of which accessible ports required shallow draft ships, and of related records from those ports. These studies were meant to isolate ships fitting the physical evidence at hand; the individual ships could then be investigated to see if they were, indeed, the Ronson ship.

Pertinent eighteenth-century colonial New York records include various maps of the city, the Naval Office Shipping Lists (NOSLs), Customs Records, *New York Gazette* and *Weekly Post Boy*, Prize Court proceedings, and merchants' records. Surviving eighteenth-century maps of Manhattan indicate that the eastern half of the 175 Water Street block was filled between 1744 and 1755.<sup>32</sup> This information reinforces and refines the artifact analysis dates, of 1747 to 1760, to provide a burial date between 1747 and 1755. The NOSLs were compiled by each colony's clerk of the naval office, or naval officer. They included much information about each merchant ship that entered or cleared the colonial ports. Unfortunately, all of the records do not exist. For New York the records generally survived from 1715 to the Revolutionary War, but some pertinent periods are missing, including those from April 1743 to April 1748 and September 1748 to 1751.<sup>33</sup>

A study of all merchant ships of 100 or more registered tons, listed in the New York NOSLs from 1715 through 1748, identified some ships that were listed as entering the port but not clearing from it.<sup>34</sup> Unfortunately, since the records have gaps as much as five

years long, some ships may have departed or entered New York without being noted in the extant NOSLs. To cover the gaps, a team of readers at The Mariners' Museum studied all of the *New York Gazette* and *Weekly Post Boy* issues from January 2, 1732 to 1759.<sup>35</sup> The *New York Gazette*, which became the *New York Post Boy*, was a weekly newspaper, usually four pages long. It included customs house lists of ships entering and clearing the port, as well as other scattered information about some of the ships, merchants, and general events in the port. Combining information from the *New York Gazette* and *Weekly Post Boy* and the NOSLs revealed a number of ships that could be the Ronson ship, but no ship stood out as the obvious choice.<sup>36</sup> Several ships came into New York between 1725 and 1755 that were between 100 and 250 tons and were built in the southern colonies, but the existing records indicate that all of them left the port.

Other than Virginia, the only two British colonies which possessed live oak for the ship were North Carolina and South Carolina. According to C. Clouse's study of southern shipbuilding, only one ship in either of the Carolinas could have been the Ronson ship – a 150 ton vessel built in 1717 in Charleston, South Carolina. All of the other ships built in North or South Carolina before 1740 were smaller than 120 tons.<sup>37</sup> The one ship proved to be the *Princess of Carolina*, which visited New York in 1723, but it last appeared in the surviving records leaving New York for Lisbon in April, 1725.<sup>38</sup> If the Ronson ship was not the *Princess of Carolina* it probably was not built in North or South Carolina.

By process of elimination we find that the Ronson ship was probably built in Virginia, whose major export in the early eighteenth century was tobacco. In the late seventeenth and early eighteenth centuries many British shipwrights emigrated to the Chesapeake to build ships for the rapidly expanding merchant fleet of the English Empire.<sup>39</sup> In a study parallel to that for New York, I extracted and analyzed similar information from the Virginia NOSLs



from March 1727 to December 1752, looking for clues of southern built ships which disappeared at the proper time or which also appeared in the New York NOSLs or the *New York Gazette* and *Weekly Post Boy*. Again, several ships were the proper size and built between 1700 and 1740, but I found no evidence to suggest one vessel more than the others.

Another possible source for the Ronson ship, not necessarily reflected in the NOSLs or the newspapers, was the warfare that was waged during the 1740s and 1750s. During the War of Jenkins' Ear (1739-1743), King George's War (1743-1748), and the French and Indian War (1754-1763) many French and Spanish prizes were brought to New York by the British navy and privateers. After a hearing in prize court, to ensure that the vessels were legal prizes, they were generally sold at auction at the wharf. Most prizes undoubtedly were constructed in Europe. How many were built in Virginia, and either sold to the Spanish and French or taken as prizes by them before being taken again as British prizes, is difficult to determine.<sup>40</sup> The Ronson ship could have been built in Virginia, brought in as a prize of war, and bought or abandoned for use as fill. Research in the Vice Admiralty Court Records, which contain the prize court proceedings, failed to provide any direct evidence about the ship at 175 Water Street.<sup>41</sup>

I have not yet determined the identity of the Ronson ship, but by combing facts with probabilities from morphological, archaeological, biological, and archival research, one can arrive at a reasonable hypothesis about the ship's generic identity. Morphological data indicates that she was a British merchant frigate with flat floors, built to sail into shallow waters, and that she was abandoned because she had outlived her usefulness. The artifacts found in the ship suggest that it was a British ship, retired after 1720 and buried between 1747 and 1760. Biological analysis indicates that the ship was built in Virginia or the Carolinas, was used for seven-to fifteen years, and was in a warm water port in the last

three years of her sailing career. Archival research narrows the ship's story to a Virginia-built ship which was buried between 1747 and 1755. Because the ship could have been fifteen years old and abandoned in 1720, or seven years old when abandoned in 1747, the ship was probably built between 1704 and 1740. Since most ships trading in Virginia in the early eighteenth century sailed into shallow water to obtain a cargo of tobacco, the shallow-draft Ronson ship probably, but not definitely, was built to be a Chesapeake tobacco carrier.

In general, it appears that the Ronson ship was first built in Virginia by a British shipwright between 1704 and 1720. She was probably built to be a tobacco carrier between the Chesapeake and the British Isles and performed her intended mission between 1720 and 1730, but how long she lay in the harbor as a storage ship or a derelict can not be determined. In Manhattan she was either sold or abandoned to act as bulk for fill in the new waterfront at what is now 175 Water Street and was placed and filled between 1747 and 1755. The remaining interpretations in this paper are based on this hypothesis.

## NOTES, CHAPTER 2

1. Members of the hull analysis and illustration team were: William Ackiss, Al Foster, Ed Hoffman, George Matson, and Sheli Smith.
2. William Sutherland, *The Shipwright's Assistant, or Marine Architecture* (London, 1726), 87.
3. John J. McCusker, "Colonial Tonnage Measurement: Five Philadelphia Merchant Ships as a Sample," *Journal of Economic History*, 27 (1967), 82-91. Gary M. Walton, "Colonial Tonnage Measurements: A Comment," *Journal of Economic History*, 27 (1967), 392-397. Christopher J. French, "Eighteenth-Century Shipping Tonnage Measurements," *Journal of Economic History*, 33 (1973), 434-443.
4. Albert Sebillé, *Histoire de la Marine* (Paris, 1934), 195. Fredrik Henrik af Chapman, *Architectura Navalis Mercatoria* (New York, 1968 [orig. publ. Stockholm, 1768]), Plates I-XXV.
5. Chapman, *Architectura Navalis Mercatoria*.
6. David R. MacGregor, *Merchant Sailing Ships 1775-1815: Their Design and Construction* (Watford, U.K., 1980), 20.
7. MacGregor, *Merchant Sailing Ships*, 24.
8. Chapman, *Architectura Navalis Mercatoria*, 86.
9. William A. Baker, *The Development of Wooden Ship Construction: A Brief Historical Survey to the Nineteenth Century* (Quincy, Mass., 1955), 28 & 30.
10. Chapman, *Architectura Navalis Mercatoria*, 5-7. The Chapman Collection, MS. Swedish Maritime Museum, Stockholm [available on microfilm].
11. Chapman, *Architectura Navalis Mercatoria*, plates LII and LIII. MacGregor, *Merchant Sailing Ships*, 21-23.
12. Jean Boudriot, *The Seventy-Four Gun Ship* (Paris, 1986), 79. Mungo Murray, *A Treatise on Ship-building and Navigation* (London, 1754), 185.
13. Brian Lavery, *The 74-Gun Ship Bellona* (London, 1985), 10. Peter Marsden, *The Wreck of the Amsterdam* (New York, 1975), plate XII.
14. Sebillé, *Histoire de la Marine*, 146 & 196. Jean Boudriot, *The Seventy-Four Gun Ship*, plate XV.
15. A similar variation of draft marks was noted on remains of a Swedish ship which wrecked in 1730 – Carl Olof Cederlund, personal communication 1986.
16. Jay Rosloff, *The Water Street Ship: Preliminary Analysis of an Eighteenth-Century Merchant Ship's Bow* (College Station, Texas, 1986), 71. Lester Ross, *Archaeological Metrology: English, French, American, and Canadian Systems of Weights and Measures for*

*North American Historical Archaeology* (Ottawa, Canada, 1983), 77.

17. Joan Geismar and Sheli O. Smith, personal communications 1982.

18. Joan Geismar, *The Archaeological Investigation of the 175 Water Street Block, New York City* (Marietta, Georgia, 1983), 698.

19. Geismar, *175 Water Street*, 698. Ivor Noël Hume, *A Guide to Artifacts of Colonial America* (New York, 1976), 298-303.

20. W. M. Harlow, et al., *Text Book of Dendrology*, 3d ed. (New York, 1950), 372-373. Virginia Steele Wood, *Live Oaking: Southern Timber for Tall Ships* (Boston, 1981), 8.

21. Wood, *Live Oaking*, 8, 15, 46.

22. Harlow, *Dendrology*, 85-95.

23. Harlow, *Dendrology*, 230-235.

24. Wood, *Live Oaking*, 15.

25. Ruth D. Turner, *A Survey and Illustrated Catalogue of the Teredinidae* (Cambridge, Mass., 1966), 6-8.

26. Turner, *Teredinidae*, 111, 260.

27. Turner, *Teredinidae*, 93, 258-261.

28. Turner, *Teredinidae*, 259, 261.

29. Ruth D. Turner, personal communications, April 1983.

30. Issac N. Stokes, *The Iconography of Manhattan Island, 1498-1909* (New York, 1928), plate 34.

31. Amy Freidlander, "175 Water Street History" (unpublished report, Soil Systems, Inc., 1981). "Alexander Papers" MS., New York Historical Society. "Account Book of Ann Elizabeth Schuyler, 1737-1769" MS., New York Historical Society.

32. David Grim, "A Plan of the City and Environs of New York in 1742-44," (1813) and F. Maerschack, "A Plan of the City of New York From an Actual Survey in 1754," (1755) in Stokes, *Iconography of Manhattan*, plates 32a and 34.

33. P.R.O., C.O., New York Naval Office Shipping Lists (NOSLs), 1715-1750, (available on microfilm).

34. This study was conducted by transcribing information from the NOSLs into an Apple microcomputer, then alphabetically sorting by "ship's name" and chronologically subsorting by "date of record entry."

35. *New York Gazette and Weekly Post Boy*, Jan. 2, 1732 to Dec. 1759. Members of the reading team were: Linda Brown, Katherine Kelly, Joe Powell, Virginia Powell, Linda Rogers, Sheli Smith, and Warren Riess.

36. P.R.O., C.O., Virginia NOSLs, 1698-1760 (available on microfilm).
37. Converse Clowse, "Shipowning and Shipbuilding in Colonial South Carolina: An Overview," *The American Neptune*, 44, 1984, 229.
38. P.R.O., C.O., New York NOSLs, 1725. P.R.O., C.O., Virginia NOSLs, 1727-1752.
39. Joseph A. Goldenberg, *Shipbuilding in Colonial America* (Charlottesville, Virginia, 1976), 53. Ralph Davis, *The Rise of the English Shipping Industry in the 17th and 18th Centuries* (Devon, U.K., 1972), 67.
40. Monro B. Lanier, *History of Southern Shipbuilding* (Pascagoula, Miss., 1953), 2.
41. P.R.O., C.S.P., Col. Ser., 13-16. P.R.O., C.O., 5:1061, 215 & 216.

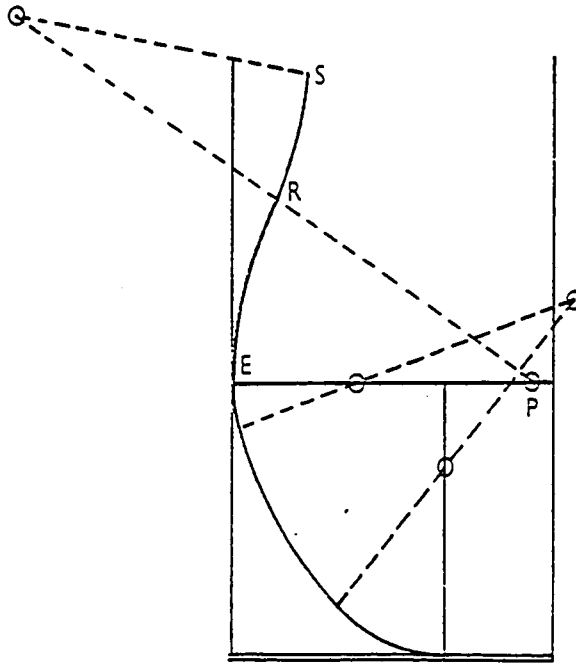
### Chapter Three      Building the Ship

Shipbuilding in the English American colonies began when the first colonists settled the coast. In 1607 a 40-ton pinnace, the *Virginia*, was launched at the short-lived Popham colony in Maine. The colonists had an acute need for ships and boats, for they were almost the only means of transporting people, goods, or information for long distances in America and across the Atlantic. The colonists also used water vessels to fish for food and profit and to protect their coastal settlements and trade from foreign enemies and pirates. The mother culture in the British Isles, maintained a strong seafaring tradition, and therefore it was only natural that the colonists should maintain the tradition in America.

America was almost a perfect place to build ships. Dense virgin forests of good wood bordered rivers and salt water along thousands of miles of shoreline. The geology of the shoreline also helped, for the Appalachian Piedmont met the Atlantic and its estuaries in a gentle slope of land, ideal for launching boats and ships. In the northern colonies, white oak served well for ships' structural timbers, though it was not considered as rot resistant as English oak. In contrast, northern white pines were considered ideal for masts and spars for ships. Colonial white pine was used locally and shipped to England and the West Indies to be used on ships from many nations.<sup>1</sup> In the southern colonies, Virginia, North Carolina, and South Carolina, other shipbuilding woods were well known — live oak, juniper, pitch pine, and yellow pine.<sup>2</sup> Though live oak was considered too hard to work until the mid-eighteenth century, the other three woods were used for shipbuilding in the first southern settlements.

Shipbuilding in the southern British colonies was slow until near the end of the colonial period. Most settlers were too busy growing tobacco, rice, and indigo for export to spend their time in the less profitable exercise of building ships. Southern products were in enough demand in Britain so that the colonists need not transport their own products, but rather wait for the English and Scottish to pick up the colonial products with their ships. Until the 1730s few ships were built in the South, and those few were generally built for or sold to British merchants.<sup>3</sup> The tobacco and grain trade out of the Chesapeake was different from most other trades in the colonies. To conduct this specialized trade, a style of ship may have developed which safely and efficiently would carry staples from the Chesapeake to the British Isles. Until studying the remains of the Ronson ship we knew little of the Chesapeake ships.

Seventeenth- and early eighteenth-century ship design and shipbuilding techniques can be understood only through a series of short shipbuilding treatises and the archaeological study of located ship remains. In his *Doctrine of Naval Architecture* (1670) Anthony Deane presented some of the basic arithmetic and geometry for designing the hull of warships. His method was similar to, but better explained than, an anonymous treatise written c. 1620.<sup>4</sup> Deane, Master Shipwright at the Royal Navy Yards in Harwich and Portsmouth, was well known in his career for designing successful warships. He designed the midships frame cross section with the use of simple geometry and sweeps, or sections of a circle's circumference (See Figure 14). As he progressed fore or aft of midships, he raised and shifted the center of the sweeps to diminish the curvature. Deane's treatise addressed general ship design, but not how to vary the general design for various ships, not how to geometrically design a successful bow and stern, and not how shipbuilding was actually conducted. However, in a series of tables, he did list the size and quantity of timbers for warships from first to sixth rate (100 to 15 guns).



**Figure 14.** Geometric method of drawing the cross section of a warship. From Brian Lavery, *Deane's Doctrine of Naval Architecture*, 1670 (Greenwich, 1981), 67-69.



William Sutherland, a third generation shipwright at Portsmouth and Deptford, published the first text-book for shipwrights in 1711. Sutherland referred to ship design, and that it was based on portions of the surface of a "globe," but he concentrated on the techniques of purchasing timber, which to use, and how to build a ship. However, he did include one simplified draft of one merchant ship. Like Deane, he also presented sizes and quantities of timbers needed for various war ships.<sup>5</sup> Later in the mid-eighteenth century, Mungo Murray, a shipwright in the royal shipyard at Deptford, presented some basic principles of ship design and construction, but he provided scarce new material. Like its two predecessors, Murray's treatise of 1754 primarily addressed the design of warships, rather than merchant ships.<sup>6</sup>

Little else of note was published on eighteenth-century design and shipbuilding until Fredrik Chapman's *Architectura Navalis Mercatoria* (merchant ship architecture) in 1768.<sup>7</sup> Chapman's work was a collection of ship and boat plans with a short treatise on various aspects to be considered when designing a ship. His publication included a presentation of examples, with little explanation, rather than a detailed text on either design or construction. However, in a short preface he described some of the first scientific tests to be made on ships' hulls, including water resistance and moment of stability.

Together, Deane, Sutherland, Murray, and Chapman would provide a general picture of ship design and construction if they dealt with the same type of ships during the same time period. Instead we are left with four works published over a period of ninety-eight years: a treatise on designing warships, another on warship construction, a simplified version of the two, and a fourth publication which is a collection of merchant ship plans. Documentary evidence about colonial period merchant ship design and construction are therefore minimal. Maritime historians mostly have depended on artists' ship portraits for descriptions of

colonial merchant vessels.<sup>8</sup> As Joseph Goldenberg wrote in 1976, "The ship he launched, not plans or books, was the testament of his workmanship. Thus the colonial shipwright leaves modern historians puzzling over the literature of his trade, without substantial records to settle the issue of how his craft was actually practiced."<sup>9</sup>

Unfortunately, archaeological evidence is also meager from this period. Except for the Ronson ship, no American built colonial merchantman has been archaeologically investigated. The Brown's Ferry and Hart's Cove wrecks were smaller coastal or riverine vessels from the late seventeenth and early eighteenth centuries.<sup>10</sup> The Red Bay and Isle aux Morts wrecks were sixteenth- and seventeenth-century Basque fishing ships.<sup>11</sup> The *Defence*, a Revolutionary War privateer was investigated, but it was a ship built later in the eighteenth century, especially for war.<sup>12</sup> The remains of one of Cornwallis's Revolutionary War supply ships (presently designated "YO88") at Yorktown, Virginia appear to be from a northeastern English collier which was quite different from the Ronson ship. It was scuttled into the mud in 1781 and is being excavated now, but the origin and details of the ship are not available yet.<sup>13</sup>

The only investigated merchantman from the same period is the *Amsterdam*, a Dutch East Indiaman wrecked near Hastings, England in January 1749. However, the *Amsterdam*, 150 feet (45 m.) long and displacing 700 tons, was much larger than the Ronson ship and was made similar to a large warship to protect itself during long voyages to and from the Indian Ocean. Although the ship's remains were discovered in 1969, only in 1985 did a project start to excavate and record the site. Discussions with the site archaeologists have provided little information directly related to the Ronson ship and her genre.<sup>14</sup>

A close examination of the archaeological data from the Ronson ship could therefore tell us

much about early eighteenth-century design and shipbuilding. However, one must keep in mind that this is but one ship, which may be an example of typical merchant ships of her time, an example of Chesapeake Bay ships, or an anomaly in ship design and construction. While we can formulate a general idea of how warships were designed and built in the early eighteenth century from archival and previous archaeological material, many questions still exist for early eighteenth-century merchantmen. A close inspection of the ship's timbers and fittings can provide evidence about methods of design and construction used on this ship. The nature of the evidence requires questions of construction to be answered before the ship's design can be addressed, therefore this chapter will focus on answers to questions about the ship's construction. In order to do so, we must first consider the various construction methods used in the eighteenth century.

Construction methods for the structural framing of the ship, including the acquisition and shaping of materials to build the ship, were only mentioned in generalities in one of the above four treatises. Planking and decking are given more written space, but again, we have not been able to compare the evidence from a merchant ship with the documents for warships. Shipbuilding techniques used on private vessels apparently were different than on government ships. Whereas archaeologically investigated naval warships from the period have shown a tendency of the builders to systematically space and carefully finish timbers, which suggests that they closely followed a plan, the American Revolutionary War privateer *Defence*, the Hart's Cove wreck, and the Brown's Ferry wreck were not built so carefully.<sup>15</sup> A question therefore has existed about the work accomplished by the eighteenth-century shipwrights who built ships outside of the royal dockyards: how did they balance between plans for a wooden ship and the necessity to work with available, less expensive material which might not fit drawn or traditional details? The attitude of these craftsmen may be reflected in the Ronson ship's construction.

When studying eighteenth-century documents on construction techniques, one is never sure whether the author was describing how only he did something, how it should be done, or how almost everyone conducted similar tasks. Similarly, the problem exists in history and archaeology, where the interpreter must decide whether a document or object was standard, typical of a particular region or usage, or anomalous. We are presented with both problems with the Ronson ship, because few examples of treatises on ship construction exist and no similar ships have been discovered and studied. If the documents and ship remains indicate a similar method of ship design, they would imply, but not prove, that there existed a common technique. If they do not agree, they may only be single examples; each could be anomalous.

The first steps in building an eighteenth-century ship were to lay down the keel and erect the stem and stern post timbers. The shipwright then constructed the frames and other structural members, fastened the outer and ceiling planking to the structure, and finished the inside with decks, hatches, bulkheads, and other needs. Before launching the ship, builders attached the knee of the head and covered the below water outer planking with animal hair, pitch, and soft wood sheathing. Masts, spars, and rigging were generally added after launching.

Gathering and shaping the necessary wood and iron were a major part of building a ship. Contemporary illustrations of ship yards show them to be similar to modern small wooden vessel yards. One or two ships were under construction, surrounded by scaffolding and men with various specialized tools. Piles of compass timbers (naturally curved branches and tree trunks) and planks of various sizes were close at hand. Some of the hand tools remain basically the same, such as adzes, hammers, caulking tools, bevels, levels, and hand saws.

Large timbers were generally cut to length with a pit saw and shaped with an axe and adz. Planks were split or sawn. Splitting was accomplished with a froe and mallet, and rip-sawing (cutting length-wise) with a water-powered saw which moved up and down or a hand powered pit saw. When using a pit saw, two men cut a horizontal log with one man above and the other below the log. They held the saw at 45-to-60 degrees from horizontal by either resting the log on large saw horses or having the lower man in a pit. On the Ronson ship, tool marks on the surfaces of the stem, frames, keelson, and other structural members indicate that the builders fashioned the heavy timbers with axes and adzes. Deck, outer, and ceiling planking on the ship had diagonal, irregularly spaced saw marks on their surfaces, indicating that they were cut with hand-held pit saws. Pit saws were operated at lumber yards and ship yards, so one cannot tell if the planks were transported to the shipbuilding site as logs or planks.

The method of raising ships' frames varied. When building a ship by rack-of-eye (by memory), the builder generally considered the size and shape of the vessel he wanted to make, roughly shaped and constructed every fourth or fifth frame on a horizontal platform, and then raised and supported those frames in place on top of the keel. These frames were called mold frames, for they would provide the general shape of the ship and therefore act as guides for shaping the remaining frames. Three or four ribbands, which were long planks acting as battens, were then laid longitudinally from stem to stern post against the outside of the frames. The mold frames were dubbed (adzed to shape) and moved a little fore or aft until the ribbands were flush against the outer surface of every mold frame. Then the shape was considered faired. After fairing the mold frames, workers erected the intermediate frames by building them up from the keel, first the floor timber and then each futtock was attached. As the frames were built, they were positioned and dubbed to fit the shape defined by the ribbands.

A similar method was often employed when the builder used mold patterns or worked from plans. The shape of each mold frame was taken from a written or remembered plan and drawn at full scale on a mold loft (horizontal platform or floor) with sweeps and chalk. Mold frames were then constructed and shaped to the chalked lines. They were erected over the keel in the proper places and the intermediate frames were built to match the ribbands.

In one method of construction, instead of forming the mold frames on the loft, light deal (softwood plank) patterns were made on the loft to help shape the construction of each mold frame. The inside edge of each deal pattern was cut to the required outside curve of its corresponding frame. The pattern was erected in the proper place near the keel, and the floor timber and futtocks were shaped and attached to fit the inside of the pattern. Once the frames were up and the patterns removed, ribbands would still be attached to the frame structure to help indicate any mistakes and guide the construction and dubbing of the intermediate frames to finely match the mold frames' outer surfaces for the planks to come. In a variation of this method, the hull was constructed in layers. The mold floor timbers were attached to the keel, then ribbands and intermediate floor timbers were fastened and the structure was planked. The shipwrights continued up the side of the hull repeating the pattern. This method was used on the Dutch East Indiaman *Batavia*, built c. 1615, and was used for building a ship in New York in 1717.<sup>16</sup>

In another technique, every frame or its deal mold for the ship was constructed directly on the loft to match the chalk offsets, then the frames or molds were raised into position on the keel. If the frames were made on the loft, it had to be close to the construction site to facilitate their erection because of the weight of each assembled frame. Sometimes this was accomplished with a scribe board, a platform placed across the keel (See Figure 15). When molding each frame on the loft, the builders could start from either end of the ship or raise

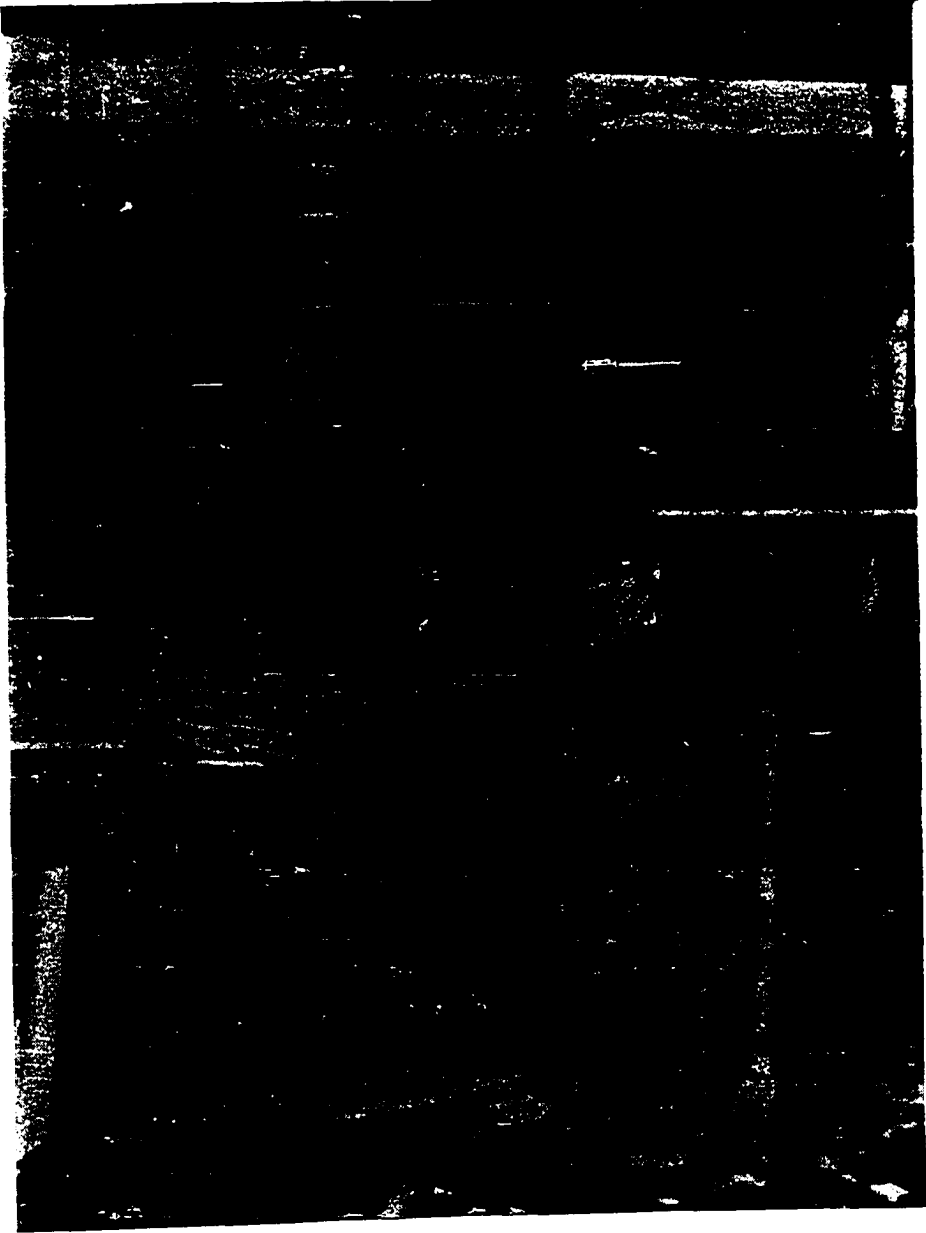


Figure 15. Scribe board used in ship construction. Hahn Diorama courtesy of The Mariners' Museum.

the midships frame first and move forward and aft from it. The method required a thorough knowledge of the hull to be constructed and an accurate drawing and construction of each frame on the loft. Variations of this method are used by many ship yards today.

Each method had certain benefits and presented specific problems. When using the mold frames-ribbands-intermediate frames method, one did not have to know the exact shape of each frame. However, the shipwright had to build each intermediate frame by lifting, positioning, and attaching each futtock. The futtocks were curved oak timbers, each of which on the Ronson ship weighed between 200 and 300 pounds (90 and 136 kg.). Positioning and attaching them could not have been easy.

When each frame was constructed on the loft, the builder had to know the shape of each frame before it was raised. The method required more calculations and increased the chance of errors, which might not be discovered until later in the ship's construction. Only a well taught and practised shipwright could use the method successfully. However, in this method less wood was used, because there was less dubbing; each frame could be constructed on a scribe board and then raised into position by bracing its bottom in the proper place over the keel and hauling the tops up with block and tackle – probably an easier task. If the builders used deal patterns for either method, they could build the ship far away from the loft. They had to transport whatever they constructed on the loft to the keel, and the patterns weighed much less than completed frames (1 to 2 tons each on the Ronson ship).

Sutherland and Murray both discussed how they constructed ship frames. Sutherland chalked the shape of every frame on a loft, made a deal pattern to match, and shaped each floor and futtock to match the pattern.<sup>17</sup> He did not record whether he constructed each frame on a scribe board or vertically over the keel. Murray described a similar method of



shaping a pattern for each frame. Like Sutherland, he did not record how he constructed the frames.<sup>18</sup> However, one passage, "when every frame is erected into its proper place," implies that the frames were constructed horizontally and then raised onto the keel.<sup>19</sup> Yet, his use of words throughout the treatise suggests that he might also have meant that each frame was constructed in its proper place. Both eighteenth-century shipbuilders therefore drew the shape and made a pattern for every frame before it was constructed, rather than constructing a few mold frames and shaping the rest to match ribbands attached to the mold frames.

The method of construction used by the Ronson ship's builder can be discovered by inspecting the ship's frames. The futtocks, which formed each frame, were trunneled together fore-and-aft. This would have been impossible when using the mold frames-ribbands-intermediate frames method of construction, because the trunnels were typically 17 inches (43 cm.) after dubbing and the space between frames varied from only 0-to-7 inches (0-to-18 cm.). This means that the Ronson ship's builders shaped each futtock, formed each of the frames while it was horizontal, trunneled the futtocks together, and then placed each frame over the keel (See Figure 8). The shipwright therefore knew the shape of each frame before construction.

If the shipwright followed the methods described by Sutherland and Murray, he chalked out the frames' shapes on a loft and made a deal pattern for each frame. The frames were probably constructed on a scribe board over the keel. As each was made, it was raised into its position. The space between each frame varied throughout the Ronson ship, though within each area along the keel the spacing was approximately the same (See Table III). The general change in spacing for each area may have been a design consideration, but the local variance of approximately 1 inch (2.5 cm.), sheds light on the construction technique.

TABLE III DIMENSIONS OF RONSON SHIP'S FRAMES

Frame #	Sided (width, fore- and aft) (inches)	Molded (thickness, inside to outside) (inches)	Space (aft to the next frame) (inches)
T	16	-*	0
S	8	-	0
R	13	11	0
Q	15	11	4
P	15	11	2.5
O	15	9	3
N	15	9	wall
LOT 31/32 WALL MASKED FRAMES M-F			
E	14.5	8.5	7
D	13.5	8	7
C	14	8.5	5.5
B	14	8.5	6.5
A	13.5	8	3.5
O	14	8	7
1	15.5	8.5	7
2	13.75	8	7
3	14	8.5	7
4	14.25	8.5	6
5	14.5	9	5
6	15	9	6
7	-	-	-
8	8	9	wall
LOT 33/34 WALL MASKED FRAMES 9 AND 10			
11	8	9	4.5
12	17.7	9	6.5
13	17	9	7.5
14	17.75	9.5	7
15			
16			
LOT 34/35 WALL MASKED FRAMES 17 AND 18			
19	4	-	-
20	-	-	-
21	16.5	8	0
22	-	5	0
23	19	13	0

\*Because of conditions at the site, some measurements could not be taken.

Either the variance was considered to be within acceptable tolerances or it represented an intentional fore or aft shift of raised frames to match the shape of the frame to ribbands. However, since in this construction method the ribband would not be attached until all the frames were raised, and each frame needed to be attached to the keel as it was raised, it is doubtful that the frames were purposely shifted fore-or-aft to match ribbands. The 1-inch (2.5 cm.) variance therefore appears to be accidental, but within the acceptable tolerances of the shipwright. The frames of the Ronson ship, and probably all major structural members, appear to have been fashioned from a species from the white oak group, probably live oak. Live oak (*quercus virginiana*) is a particularly hard and dense wood. Early shipbuilders shunned it because of its extreme hardness when seasoned. However, live oak's natural curves, so important for making ships' knees and other support timbers, eventually drew shipbuilders to experiment with it. By the 1740s shipwrights had learned to work the wood while it was still green, and season it after cutting.<sup>20</sup>

Outer and ceiling planks were also made of oak, but their species is not as discernible. The planks were pit-sawn to the proper size. The outer planks were charred on the inside surface, indicating that the builders heated each plank over a fire to make them flexible before attaching them to the frames. This was a common British practise before steaming planks came into vogue in the late eighteenth century (See Figure 16).<sup>21</sup>

The ship was fastened mostly with wood trunnels and some iron drifts and square nails. Trunnels were preferred to iron fasteners where great strength was not needed, because they provided a tighter fastener for a longer time and they were cheaper. As the ship moved through the water, especially in heavy seas, internal stresses tried to move the timbers in

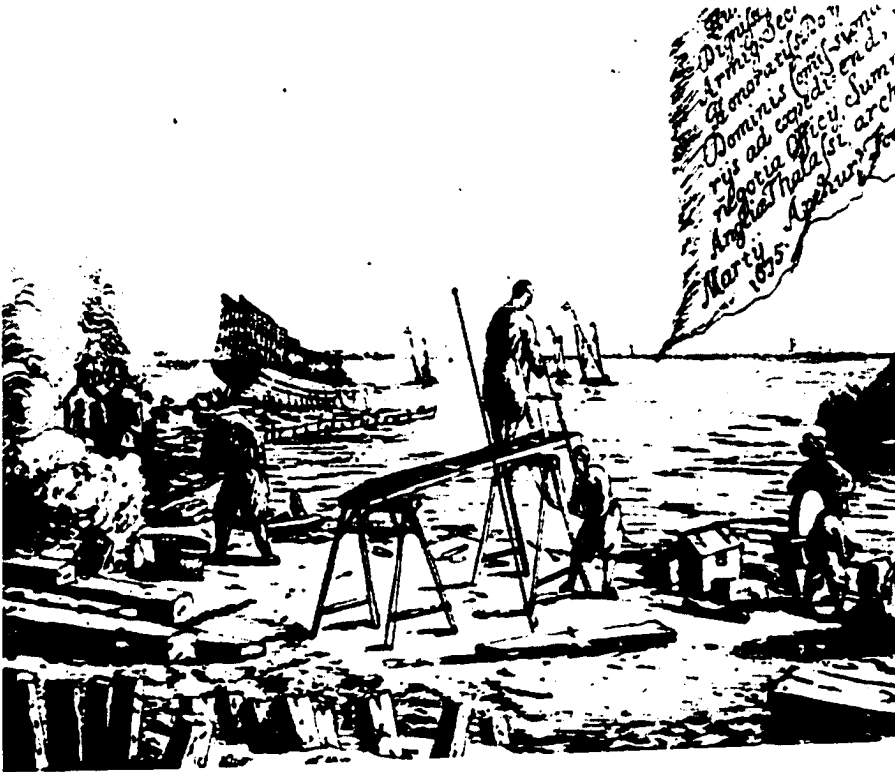


Figure 16. Charring planks before attaching them in 1675. From Wescott Abell, *The Shipwright's Trade* (Greenwich, 1981), plate XIV.

relationship to each other. Wood trunnels flexed with the wood, did not corrode, and, because they were the same hardness, did not wear away the inside surface of the hole. Iron fasteners were stronger, but they were also rigid, corroded, and ground away the wood around them. Costs for trunnels varied by location and time, but in 1726 England Sutherland paid £1 for a thousand Ronson ship-sized trunnels.<sup>22</sup> Prices may have been similar for trunnels in America, where timber was cheaper but labor was more expensive.<sup>23</sup>

The trunnels used on the ship were made from various species, but mostly oak. Since oak was considered to be the best, if not the only, wood to use for trunnels in the eighteenth century, the use of other woods presents a bit of a mystery.<sup>24</sup> Oak for trunnels should have been plentiful throughout the British Empire, for even small trees, or limbs and remainder pieces from large trees, could be used for trunnels. Yet some of the Ronson ship's trunnels are pine, juniper (much weaker woods), ash, and hickory. Perhaps the shipwright was caught with a particularly short supply of oak at the wrong moment, but that is doubtful. Instead, the ship may have been repaired at sea. Perhaps some trunnels worked loose or rotted in a voyage and were replaced by whatever the carpenter had in stock, which may have been pieces of an extra spar (pine) or oar (ash) which he carved into trunnels.

The trunnels were octagonal, having been made with a draw knife or hatchet rather than a lathe. The corner edges of the octagonal trunnels bit into the sides of the round holes, making a particularly tight fastener. Even after over 200 years of being buried, most of the ship timbers had to be wedged apart with much effort. Just a few of the trunnels had a wooden wedge driven into their ends, indicating that these few had become loose and required some expansion to keep them in place. Later in the eighteenth century, wedging the ends became common for all trunnels. The trunnels were approximately 1.2 inches (3 cm.) in

diameter, except for a few which were 1.4 inches (3.6 cm.) in diameter. This agrees with Sutherland's listing of sizes, wherein he separated them by tenths of inches rather than fractions of inches ("1 1/4," etc.).<sup>25</sup> Marks within the tunnel holes indicate that augers were used to bore holes before the tunnels were driven in.

The iron fasteners were mostly square iron nails to fasten plank ends and large iron bolts to hold large structural pieces to the keel, stem, and stern post. During the ship's 200-plus years of burial below the water table, the iron of the fasteners oxidized into various salts. The salts mostly dissolved, leaving a black goo in the fastener holes. Nothing could be learned about their construction or exact shape, except from the holes left behind in the timbers. Marks were not visible in the iron bolt holes, because of degradation, but the holes were probably bored with an auger rather than burned through with a bow drill. Because tunnels near the ends of planks tended to split the planks, large square nails were used to fasten plank ends to the structural members. Holes for the large square nails do not show indications of preboring. However, the damage caused to the wood by the deteriorating iron nails could mask any evidence.

The shipbuilders waterproofed the ship by forming three separate barriers between the cargo and outside water. Oakum calking was driven between the edges of all the outer planks and again between the edges of all the ceiling planks. The limber board, which was occasionally removed to clean the bilges next to the keelson, was not calked. On the outside of the hull planking, a 1/4-inch (8 mm.) layer of pitch and animal hair, covered by a layer of light wood planks, offered another water barrier as well as a teredo barrier. Archival and archaeological evidence indicates that calking and coating the outside planks was standard practise, but I was unable to find similar parallels for calking the ceiling planking.<sup>26</sup> However, since little was recorded about the construction of merchantmen, the Ronson ship

is the only found example of this ship type, and the practise seems like a logical way to keep a cargo dry, ceiling calking may have been standard practise for merchantmen in the eighteenth century. We must await the investigation of other merchantmen to know.

In the bow, between the wales on either side of the stem, we found strips of lead sheeting nailed in such a way that they could only have been placed there when the ship was built (See Figure 17). Each strip made a 90-degree angle, much like modern steel "angle iron," so that its aft face sat vertically between the wales and the hawse pieces, and the horizontal face lay between the edges of the wales. Each face was fastened with small iron nails. I found no archival reference or archaeological parallel to these lead strips. Their position indicates that they served as caulking in an area where waves beating on the round bow might work the timbers and pull the oakum calking out of its seams. The lead strips therefore might have served as a reserve calking for the wales in the bow.

Some details of the ship's construction might indicate that the shipwright was a bit sloppy in building the vessel. Contemporary ship designs and models showed frames, deck beams, hawse pieces, planking, and other timbers perfectly shaped, regularly sized, and evenly spaced. Yet the Ronson ship shows many variances. The frames vary in room and space (width and space between frames) dimensions by as much as 3 inches (7.6 cm.) in any area of the hull (See Table III). The deck beams vary in width by as much as 1 inch (2.5 cm.) and in spacing on the ship by 3 inches (7.6 cm.), where not forced to vary because of hatches and other structures. Hawse pieces varied in dimensions, from 9 inches (23 cm.) to 13 inches (33 cm.), to fill similar spaces on either side of the stem. In addition, deck, ceiling, and outer planks varied in width by as much as 60 percent throughout the ship. Trunnel holes, drilled from the outside, held outer planks, frames, and ceiling planks together. They were often off target, sometimes completely missing a frame.

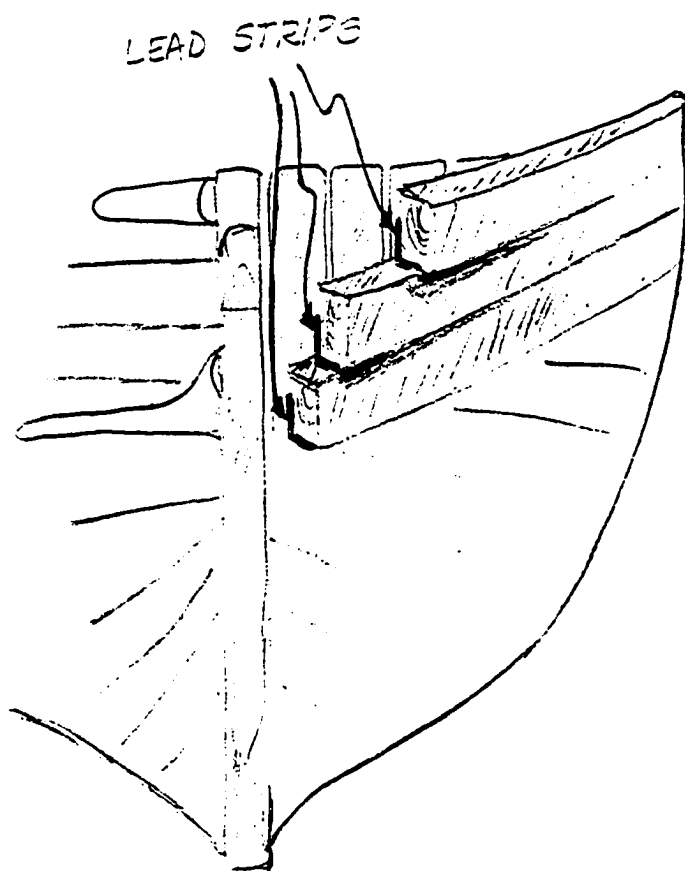


Figure 17. Lead strips between wales in the bow, probably used as secondary calking.  
(S. Smith)



Other timbers on the ship, including a breast hook, breast plate, and some knees, were originally not large enough to have been squared off to meet the shipwright's requirements. Therefore, sections of these timbers were left semi-cylindrical, close to their natural shape. Remains of the American Revolution privateer *Defence* reflect similar practises. Bark still remained on one of the *Defence*'s breast hooks, which was adzed only on the forward surface to be fair with the bow cant frames.

What motivated the builder to apparently disregard precision when building the ship can be inferred, but not accurately determined. The economics of diminishing returns, lack of material, and a lack of interest in precision may have influenced the shipwright. To find and buy the necessary timber and spend the extra labor necessary to make all the ship's pieces and spaces squared and even, might have cost the builder much more than the way he actually finished them. Although a lack of wood in colonial America seems like a contradiction, wood of the right shape and size may have been a temporary problem to this particular builder. While the ship's members and spaces did not have regular dimensions and spacing, they were fastened properly to provide a strong and water-tight vessel. Precision may never have been a goal. In fact, all three factors probably affected the shipwright's method of construction. Building a seaworthy ship, that could carry its cargo properly, for the least amount of money, the builder was required to use easily available material if it would suffice. Building a merchant ship that would work properly, rather than one whose structural members were pleasing to the eye, was his primary goal.

The evidence from the Ronson ship has illuminated some aspects of merchant shipbuilding in the eighteenth century. Details of the way the frames were fastened indicate that the shipwright knew the shape of each frame to be raised over the keel. He and his workers either shaped and constructed each frame on a skid platform or did so for a deal

mold which would then guide the construction of its respective frame. The frames were raised in a progression from either end or fore-and-aft from the midship frame. The builders used fasteners which appear to be common for a 200 ton vessel in the eighteenth century, though some of the trunnels may have been replaced with trunnels made of inferior species. Because the cargo had to be kept dry, the ceiling planks were calked and in the bow, where calking easily could have fallen out, lead strips were fastened between the wales.

The builder constructed a stout, tight ship to a design he knew, and he did so efficiently, at the cost of some precision by twentieth-century standards. The ship's remains therefore reflect the work of a shipwright who not only could build one of the most complicated structures of his era, but also could adjust his plans to build a ship economically, with the material at hand.

## NOTES, CHAPTER THREE

1. Joseph A. Goldenberg, *Shipbuilding in Colonial America* (Charlottesville, Virginia, 1976), 15. Robert Albion, *Forests and Sea Power: The Timber Problem of the Royal Navy, 1652-1862* (Cambridge, Mass., 1926), 233.
2. Converse D. Clowse, "Shipowning and Shipbuilding in Colonial South Carolina: An Overview," *The American Neptune*, 44.4, 1984, 221-244. Arthur P. Middleton, *Tobacco Coast: A Maritime History of Chesapeake Bay in the Colonial Era* (Baltimore, 1984), 253. Virginia Steele Wood, *Live Oaking: Southern Timber for Tall Ships* (Boston, Mass., 1981), 10-11.
3. Goldenberg, *Shipbuilding*, 52.
4. Brian Lavery, ed., *Deane's Doctrine of Naval Architecture, 1670* (Greenwich, England, 1981). William Salisbury and R. C. Anderson, eds., *A Treatise on Shipbuilding and A Treatise on Rigging Written About 1620-1625* (London, 1958).
5. Wescott Abell, *The Shipwright's Trade* (London, 1948), 65. William Sutherland, *The Shipbuilder's Assistant* (London, 1726).
6. Mungo Murry, *A Treatise on Ship-building and Navigation* (London, 1754).
7. Fredrik Henrik af Chapman, *Architectura Navalis Mercatoria* (New York, 1968 [orig. publ. Stockholm, 1768]).
8. William A. Baker, "Vessel Types of Colonial Massachusetts," *Seafaring in Colonial Massachusetts* (Boston, 1980), 5.
9. Goldenberg, *Shipbuilding*, 88.
10. Alan B. Albright and J. Richard Steffy, "The Brown's Ferry Vessel, South Carolina," *International Journal of Nautical Archaeology*, 8.2, 1979, 121-142. David Switzer, *Hart's Cove Wreck Site Archaeological Investigation: 1986 Field Report* (Bristol, Maine, 1986), 18-19.
11. R. James Ringer, "The Marine Excavation of the 16th-Century Basque Whaling Vessel *San Juan* in Red Bay, Labrador: A Summary of the 1982 Field Season," *Proceedings of the Fourteenth Conference on Underwater Archaeology* (San Marino, Calif., 1986), 119-124. Sheli O. Smith, *Survey of a 17th-Century Shipwreck Site at Isle aux Mortes, Newfoundland* (Bristol, Maine, 1983).
12. David Switzer, "Provision Stowage and Galley Facilities Onboard the Revolutionary War Privateer, *Defence*," *Proceedings of the Ninth Conference on Underwater Archaeology* (Austin, Texas, 1978), 39-44.
13. John Broadwater, personal communications, 1987.
14. Peter Marsden, Jon Adams, and David Lyon, personal communications, 1986-87.

15. Author's personal observations in 1981(*Defence*) and 1986 (Hart's Cove Wreck). Albright *et al.*, "Brown's Ferry," 130-132.
16. Paul Hundley, personal communications, 1987. Issac N. Stokes, *The Iconography of Manhattan Island, 1498-1909* (New York, 1928), "The Burgis View" [1717], plate 34 . Jean Boudroit shows a similar method for the early nineteenth-century French Navy in *The Seventy-four Gun Ship: A Practical Treatise on the Architecture* (Grenoble, 1986), Vol.I, 66-71.
17. William Sutherland, *The Shipbuilder's Assistant* (London, 1726), 77-84.
18. Murry, *Shipbuilding*, 134-146.
19. Murry, *Shipbuilding*, 146.
20. Wood, *Live Oaking*, 10-12.
21. Wescott Abell, *The Shipwright's Trade* , 92 & 97.
22. Sutherland, *Shipbuilder's Assistant* , 20.
23. Goldenberg, *Shipbuilding*, 75-76. Middleton, *Tobacco Coast*, 254. Sutherland, *Shipbuilder's Assitant*, 46-48.
24. William A. Baker, *Colonial Vessels: Some Seventeenth-Century Ship Designs* (Barre, Massachusetss, 1962), 96. Goldenberg, *Shipbuilding*, 16. Sutherland, *Shipbuilder's Assistant* , 48.
25. Sutherland, *Shipbuilder's Assistant* , 20.
26. Similar calking and sheathing were found on remains of a Swedish ship which wrecked in 1730 -- Carl Olof Cederlund, personal communication 1986. Middleton, *Tobacco Coast*, 256.

## Chapter Four     Designing the Ship

One of the key questions in the history of naval architecture is whether eighteenth-century builders of merchant ships worked from paper plans, a carved model, a set of molds, or "rack-of-eye." If paper plans or a carved model were used, did the designer use geometric and mathematical processes similar to those used for warships in the contemporary treatises? Similarly, did the builders of the Ronson ship, designing an economical merchant ship in colonial Chesapeake Bay, plan the ship's structure and finish works as would a designer for the Royal Navy? In addition, many aspects of a ship's hull and rigging must be considered when designing a ship for a specific purpose. Each of the contemporary treatises address this problem. The balance of these factors, or the compromise of necessities for a ship in the Chesapeake trade, may be illuminated by the shape of the Ronson ship. The shape of the hull might also indicate influences from one or more traditional, known ship designs.

Ships have generally been designed using one of three methods: "rack-of-eye" (memory and internal visualization), paper plans, or a three-dimensional model. Until the last 100 years, even paper plans only included the shape of the hull, and possibly the height of the deck and position of the masts. Design developments, construction contracts, and technical discussions during building were based on one of the three design methods. Thousands of details, from the method of attaching the frames to the keel, to the finish on the taffrail, were governed by local traditions or stated desires of the people involved with the ship's construction. Only artistic designs on the stern, bow, and figurehead were occasionally

illustrated for preconstruction approval.<sup>1</sup>

The first method of designing a ship, rack-of-eye, was actually more of a continuation of tradition, rather than designing a new hull type. The shipwright, after many years of apprenticeship, memorized the shape of a good ship for a desired duty. He and his helpers constructed and shaped mold frames, attached ribbands, and constructed the remaining frames. It was the shipwright's memory and eye which determined the shape and position of each timber on the ship. If the builder or future owner wanted a deviation from tradition, the shipwright determined the necessary changes in his head. Although this approach may seem primitive, after many years of work a clever builder repeatedly could construct successful vessels this way. Conscious and accidental variations in the hull's shape were possible, but changes were difficult to record for future reference and communication to others. The development of ship structure was therefore slowed by this method of design.

In the second method, the designer used paper, or another similar material, to draw the ship to scale in one, two, or three views. Decisions could be made by the owner, designer, and builder to make any changes before construction began. In Europe, the earliest use of paper drafts appears to have been in either England or Italy during the sixteenth century. The earliest English ship plans known are those attributed to Matthew Baker, dated to pre-1586.<sup>2</sup>

Baker was the Master Shipwright for Queen Elizabeth and was instrumental in increasing the seaworthiness of English ships during the late sixteenth century. In his manuscript he described a means of designing a large ship by using mathematics and sweeps (arcs, or sections of circles). His use of mathematics suggests that he was part of the new wave of scientist/ engineer/ philosophers who were attempting to apply mathematics to

their world, in order to understand it and make better use of it.<sup>3</sup> Naval architecture drafts would therefore seem to be a natural extension of the new concept, allowing the shipwright to design better ships through the application of scientific principles and the recording of trial changes in design. Paper plans would also allow the shipwright to communicate his designs to others, whether on the local level for the construction of a ship or at a distance to communicate design ideas with other shipwrights.

Before construction of a ship, the purchaser of the ship's timber, whether it was the builder or someone else, could use the draft to assemble the needed material more efficiently than before.<sup>4</sup> During construction, experienced workers could determine the shape and size of each major timber without the constant supervision of the shipwright. Both of these facts allowed ships to be built more efficiently. In addition, changes in design and construction could be evaluated because they were recorded and available, so that they could be compared with the qualities of the ship once it was put to work.

To develop a draft, the naval architect first sketched the rough shape for a ship of the necessary size for the needed purpose. This would often be accomplished similarly to the rack-of-eye method, except on paper. A base line represented the keel, the architect drew a stem and sternpost at either end of the keel, and he used basic geometric shapes to form the mold frames. Then he redrew the frames, much like dubbing and shifting the real frames, until all the details looked true in three views – plan view (top), sheer view (side), and body view (end). To check the fairness of the draft, as with three-dimensional ribbands in the mold frame method of construction, the architect drew diagonal lines from the centerline to the midships frame in the body view. When these were geometrically transferred to the other two views, any hollows and bumps in the hull's shape could be seen. Once the draft was adjusted so that all details were again true, the draft or design was said to be faired.

Intermediate frames would then be drawn between the mold frames to fit the shape (See Figure 18).

The builder and his workers could then take measurements from the draft and scale them up to full size to construct and align each important structural member so that the ship arrived at the proper shape. After transferring pertinent points of the design to the mold loft surface, the shape of each frame was drawn using frame molds or sweeps (pie-shaped sections of a circle). The use of frame molds to define the frames' shapes included a mathematical progression of the position of the molds for each frame. Therefore, if a ship design proved to be good, a builder could memorize how to use a set of molds to draw each frame for a successful ship. Today this method can be seen in small boat and ship yards in America, Europe, and the Middle East, especially where fishing boats are produced to a local standard design.<sup>5</sup> Although memorization of the use of molds for a standard vessel does not require the presence of a paper draft to construct the hull, a designer originally made the plan on paper and calculated the mathematical progression for the molds.

The third method of guiding a vessel's construction was similar to the second, except that instead of two-dimensional paper plans, or directly after the paper plans were made, a three-dimensional scale model of the ship's hull was constructed. The model usually was carved from wood and station lines were drawn around it at particular places. Then the builders could take their measurements directly off the model. Although the model was an extra step which could be a source of errors, it offered a representation of the hull which unpractised viewers found easier to understand than two-dimensional drawings, and it provided a less fragile working "plan." A shipwright might retain a series of such models to show to prospective customers and thereby simplify discussions about which kind of ship the customer might want built.



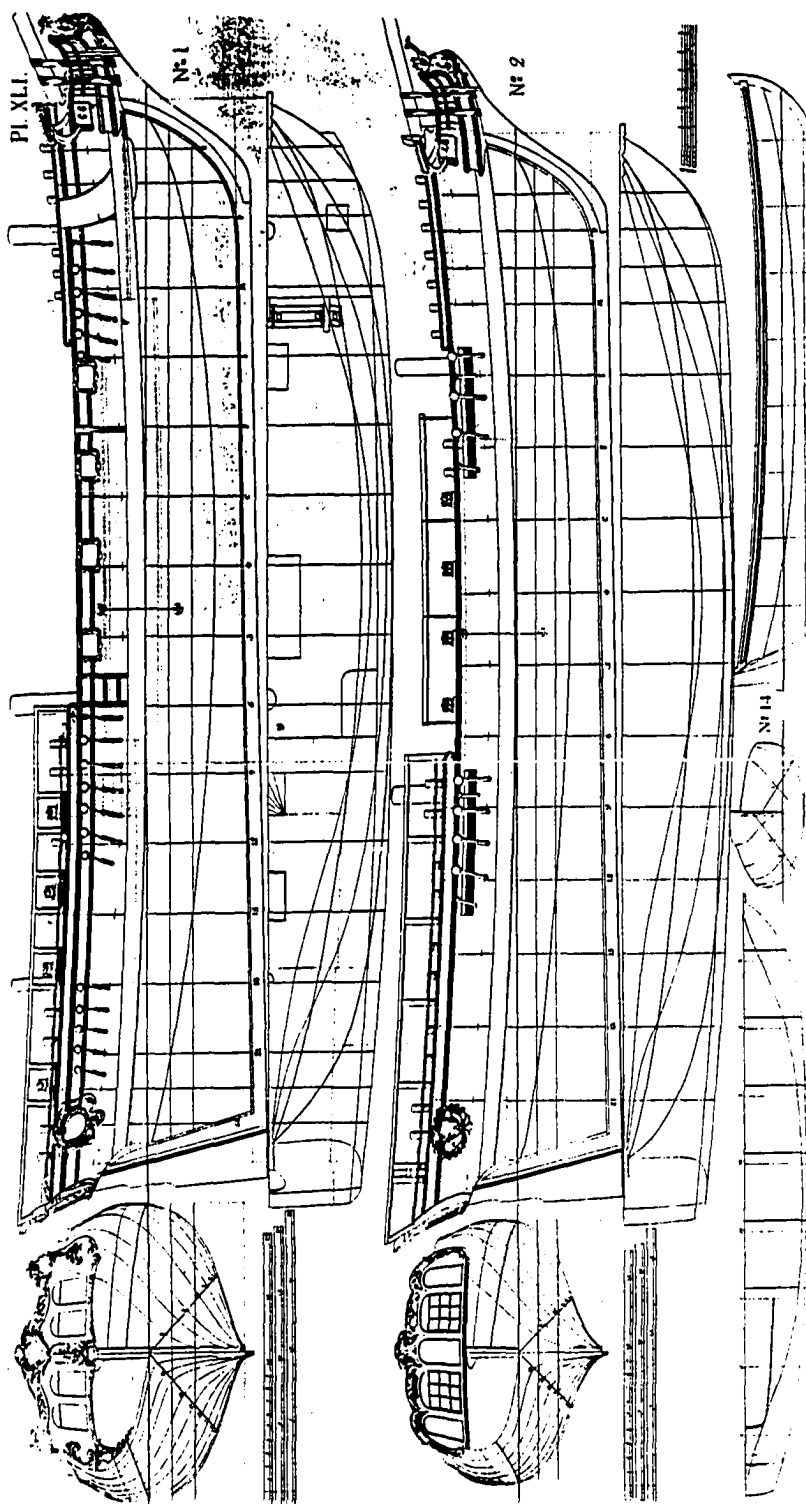


Figure 18. Faired ship lines. From Fredrik Henrik af Chapman, *ARCHITECTURA NAVALIS MERCATORIA* (New York, 1968), plate XLI.

Which of the three methods was most common in the eighteenth century is not known. In his 1670 treatise, Deane discussed how to develop a ship draft on paper, but did not describe how one converted the design into a ship.<sup>6</sup> Sutherland, working in an English Royal Shipyard, wrote in 1726 that the ship was generally drafted on paper at a scale of 1-to-48, so that every quarter-inch on the paper equaled a foot on the ship. Measurements of key points were transferred directly from the draft to a mold-loft at full scale.<sup>7</sup> Murray, writing in 1754, also described ship design and construction as using paper drafts and transferring the shape of each frame directly from the draft to the mold loft.<sup>8</sup>

As discussed in chapter three, physical evidence from the Ronson ship's remains indicates that the ship was first drafted on paper, rather than being constructed by rack-of-eye. The mold frame, ribbands, and then intermediate frames method of construction was not used on the Ronson ship. Whether the builder used a three-dimensional model as an intermediate step before construction, or took his measurements directly from the draft can not be determined from the Ronson ship's remains.

My conclusion that the Ronson ship was designed on paper does not signify whether the ship was a new or traditional design. If it had been built by rack-of-eye, from the memory of the builder, it probably would have been traditional. The late seventeenth and early eighteenth centuries were decades of change in merchant ship design, though little is known about the progression. The ships described in late seventeenth-century literature were quite different from those seen in the late eighteenth century. How much the new interest in science and mathematics influenced ship design is not clear. Fernand Braudel stated, "before the eighteenth century, science was little inclined to concern itself with practical solutions and applications ... Technology was a collection of tricks of the trade drawn from experience

of craftsmen, and it accumulated and developed at a leisurely pace.<sup>9</sup> A comparison of Deane's and Chapman's manuscripts support Braudel's statement, for the treatises show a significant change in the practise of scientific principles. Deane's 1670's treatise on ship design described geometric methods for drawing a ship's draft, but he gave practical, not calculated, reasons for the particular shape he achieved. However, in 1768 Chapman described methods of calculating various attributes of a ship, such as its moment of stability, which allowed the naval architect to scientifically design a ship's shape.<sup>10</sup>

The development of special ships to transport cargoes particular to the Chesapeake across the Atlantic, as shown in the Ronson ships's remains, may shed some light on at least one area of ship design development. The tobacco trade was not like any other. Because of the high value of the cargo, strict laws were established to ensure the quality of the tobacco when it reached market in England and Scotiand. In the early eighteenth century, the size of tobacco hogsheads (large casks) were legally standardized in each colony and tobacco inspection was instituted. Ships' cargo holds were made water tight, and the ships usually travelled in convoy, escorted by a British war ship. In order to cut transportation costs before 1730, tobacco ships sometimes picked up their cargo at a plantation site along the upper river banks, instead of at such entrepots as Williamsburg or Yorktown.<sup>11</sup>

In the seventeenth century, before tobacco was tightly compressed into hogsheads, a cargo of tobacco was light for its volume. Captured Dutch flyboats, which were noted for their high stowage volume per tons burden (capacity), were often used in the tobacco trade. Though flyboats were efficient, they were not well armed, especially for the transatlantic trade. The tobacco ships generally crossed the Atlantic under convoy of a royal warship, but these were not always all the protection they needed and they were not always available. In the eighteenth century, when packers began to compress tobacco into the hogsheads to make

them much heavier per volume, one of the most important advantages of the flyboats was eliminated. Virginia port records show few flyboats were used in the eighteenth century. Whether the early eighteenth-century tobacco ships were the same as the standard English merchant frigates or colliers, or were a combination of these types with the continental flyboats, is not evident in existing documents. We know little about any of the early eighteenth-century merchantmen.<sup>12</sup>

Comparing the hull configurations of the various ship types, the Ronson ship appears to be a combination of an English merchant frigate and a Dutch flyboat. Ships' hulls can be longitudinally divided into three basic sections, the bow, midships, and stern. Although all three parts of the hull perform a number of duties, each has a specific effect on the ship's motion through the water. The bow must move the water in front of the ship in order for the ship to proceed. A blunt bow pushes the water in front of it, forming a bow wave, and the water in the bow wave flows to either side (See Figure 19). Constantly pushing the water up into the bow wave draws much energy from the ship's power and therefore slows the ship. A sharp bow pushes the water to either side of the ship, using less energy than the blunt bow because it moves the water more horizontally than vertically. Although the sharp bow was more efficient in terms of speed and power, other functions, such as cargo capacity and shape of the rest of the ship, often determined which type of bow was needed.

The midships section of the hull was generally determined by necessary cargo capacity and draft. Flat floors provided for maximum volume for cargo per depth of hold, and more stability when a loaded ship was left aground by tides in a shallow area. However, flat floors did not offer a deep keel to help the ship sail closer to the wind. A V-shaped hull provided better sailing and speed characteristics for the ship, but at the expense of cargo capacity per draft.

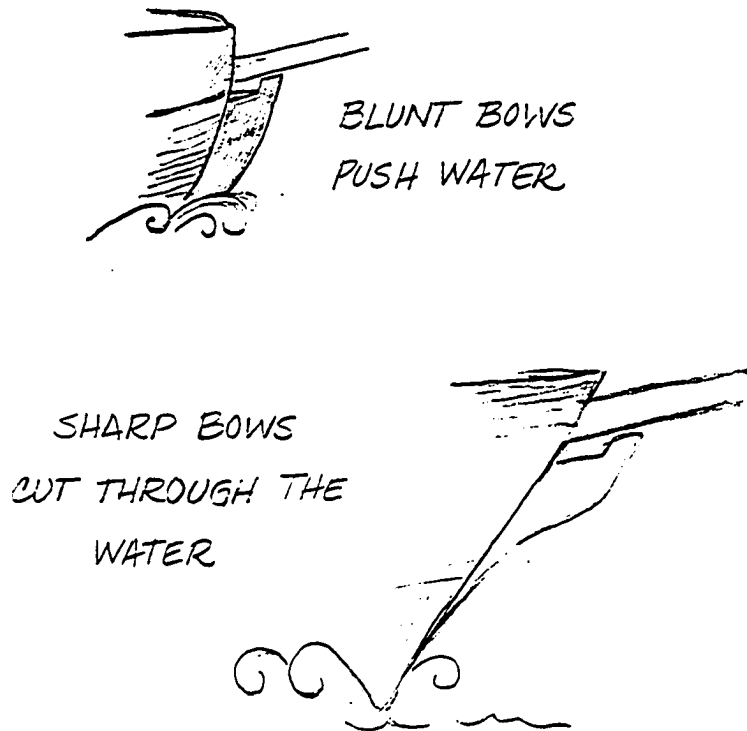


Figure 19. Sketch of blunt and sharp bows moving through water. Note that a blunt bow pushes water forward while a sharper bow moves the water aside. (S. Smith)

The hull's stern had a similar, but opposite, purpose as the bow. It closed the hole in the water, created by the bow and amidships. If the stern was full it caused a partial vacuum as the ship moved forward, slowing the ship. But a full stern provided cargo capacity. A sharp stern allowed the water to easily come together behind the ship, closing the hole made by the ship's passage, but it allowed for little cargo space.

Flyboats and frigates possessed significantly different hull shapes. A flyboat's bow was fully round above and below the water line when viewed from above. From the side, the flyboat bow's profile entered the water almost vertically, then curved back to meet the flat floors of the midship section. The stern continued the full shape of the bow and midships area, providing an almost rectangular outline of the ship when seen from above. Its bow pushed the water in front of the hull as the ship moved forward and the stern did not allow for an easy closure of the water behind the hull. The flyboat's shape offered maximum cargo capacity for a given length, breadth, and depth of hull, but its shape also rendered it useful only for slow transport in friendly waters.

When compared to a flyboat, a frigate's bow was relatively sharp when seen from above and relatively vertical when seen in profile. As the entrance mechanism for the V-shaped midship section, the sharp bow pushed the water to either side. Since the bow was not required to meet flat floors in the midship section, the lower end of the bow was not required to curve back like that of the flyboat. Speed and agility were more important than cargo capacity, therefore, both the upper and lower bow areas were fairly sharp (though not as sharp as the later clipper ships). The frigate's deeper bow added a little cargo capacity and buoyancy to the bow, but not enough to give the bow the same buoyancy or stowage capacity as those of the flyboats. However, the more vertical bow did effectively provide a longer keel forward, which gave the frigate more speed and the ability to sail closer to the wind. The

frigate's midship section offered speed and sailing ability in exchange for a lower cargo capacity, but the capacity was not drastically low. The frigate's stern was square tucked, which was sharper than the round sterned flyboats, but the frigate could have a deep or thin square tucked stern. In total, the merchant frigates provided a relatively fast and agile ship to carry less cargo, while the flyboats provided more stowage volume at the cost of speed and maneuverability.

The shape of the Ronson ship was not typical of either the flyboats or frigates. It seems to have been a combination of the two. The midships area was similar to that of the flyboats, with their relatively flat floors, hard turn at the bilge, and relatively flat curve above the floors. The Ronson ship's cargo stowage volume was therefore large in relation to her draft or in relation to the stowage volume of a merchant frigate of similar length, beam, and depth dimensions (See Figure 20).

The ship's bow appeared to be a compromise between that of the frigate and that of a flyboat. From above, the Ronson ship's bow was not as full as that of a flyboat. It was rounded, but did not reach maximum breadth quickly. However, the ship's bow had to meet its midsection, which had flat floors. In order to accomplish this, the bow profile, except for the bottom few feet, looked much like that of a flyboat, curving in depth to meet the depth of the midship's flat floors. The stern profile was drawn to be a true arc of 16-foot radius at the rabbet where the hull planking terminated. This precluded providing the hull form with a fine entrance. Some reverse curve was obtained in the lower sections of the forward frames to provide a certain degree of fineness, but the bluntness of the bow did not allow for a fast ship. The fullness provided maximum cargo capacity which was the purpose of the vessel, but also time limited maneuverability. The extension of deadwood below the waterline and forward of the curved stern piece made some improvement in the sailing qualities (See Figure 21).

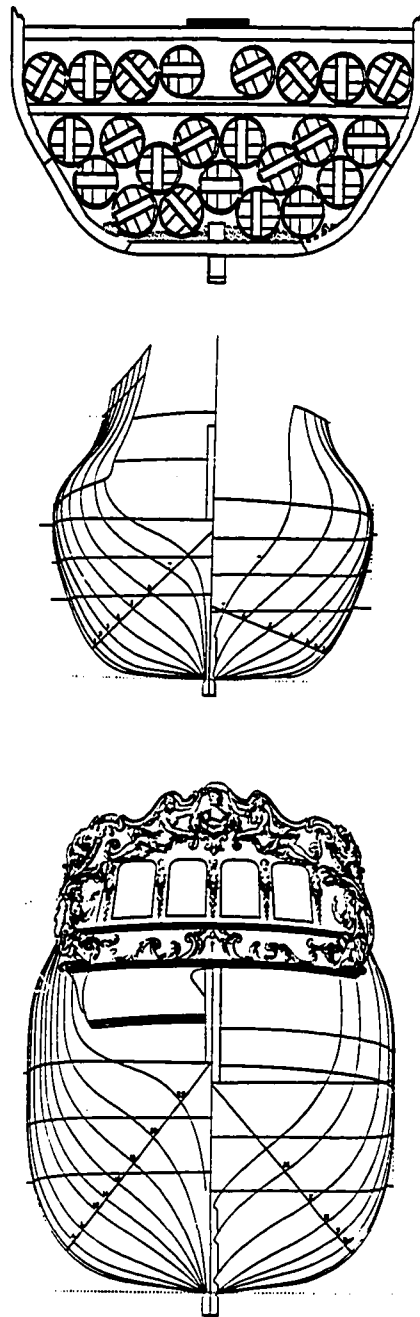


Figure 20. Cargo areas of the Ronson ship, a typical flyboat, and a typical merchant frigate. The latter two from Chapman, *Architectura Navalis Mercatoria*, plates LII and LIII. (W. Riess)



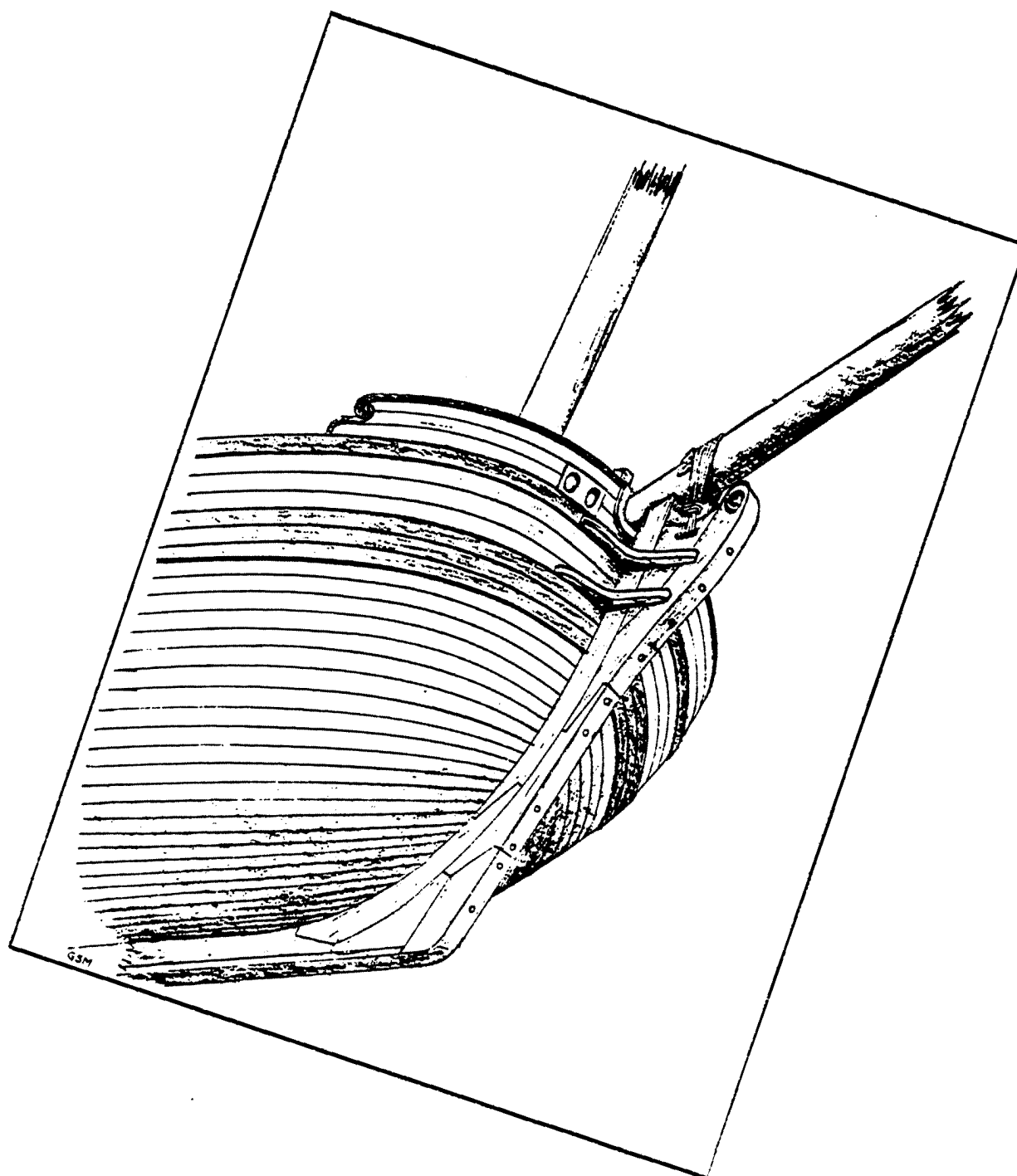


Figure 21. The bow of the Ronson ship. (G. Matson)

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

The stern of the Ronson ship was a traditional square tucked stern of an English frigate. The square tucked stern offered very little stowage space, but like the frigate bow, provided a long keel structure for speed and sailing ability. The Ronson ship's stern was wide, but vertically thin when compared to most examples in Chapman's collection; although there are a number of examples in Chapman and elsewhere of similar sterns (See Figure 22).<sup>13</sup> Evidence in contemporary paintings and engravings indicate that the square tucked stern was almost exclusively used by British shipwrights.

The Ronson ship's design therefore appears to be an adaptation of an eighteenth-century British merchant frigate, as influenced by the Dutch and French flyboats. Its design may answer Ralph Davis's question, raised in *The Rise of the English Shipping Industry in The 17th and 18th Century*, about how British ships became more efficient in the eighteenth century. Davis surmised that the Dutch and French flyboats captured in the War of Spanish Succession influenced the British merchantmen, but he could not determine how it was accomplished.<sup>14</sup>

The development or trial of this type of ship in the early eighteenth century appears logical in retrospect. British merchants and shipwrights alike knew the qualities and drawbacks of their frigates as well as those of the flyboats. If the combination worked well, the ship retained much of the frigate's speed, agility, and defensive fighting ability, while being able to carry more cargo into shallow areas. This design combination was excellent for the Virginia trade, where limited protection, cargo capacity, and shallow draft were all useful. Every ship was a balance of factors that often were opposed to each other. The Ronson ship's overall shape and dimensions may reveal which qualities the architect and owner felt were most important for the ship. For example, a bluff bow provided more stowage volume but

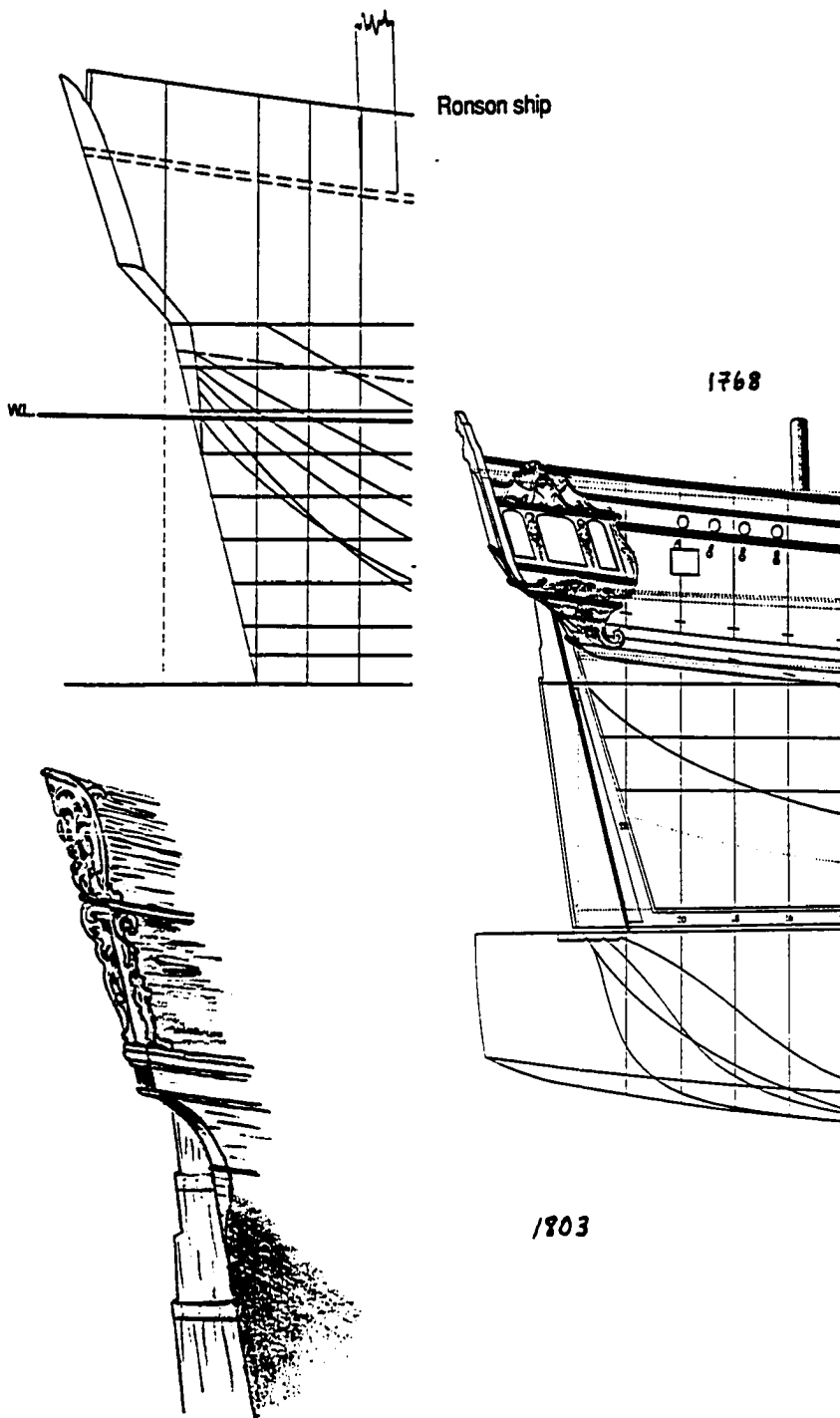


Figure 22. Sterns of the Ronson ship, a 1768 English frigate (Chapman, plate LII), and a model of an 1805 British royal yacht (The Mariners' Museum). (W. Riess)

slowed the vessel. Therefore choices and compromise had to be made for every vessel design.

Each of the four mentioned seventeenth- and eighteenth-century authors addressed the problem, but Chapman was the most succinct:<sup>15</sup>

A merchant ship ought:

1. To be able to carry a great lading in proportion to its size.
2. To sail well by the wind, in order to beat easily off a coast where it may be embayed, and also to come about well in a hollow sea [a sea with steep waves].
3. To work with a crew small in number in proportion to its cargo.
4. To be able to sail with a small quantity of ballast.

[Chapman described four example combinations, three of which appear to apply to the Ronson ship:]

To procure these advantages to a ship, it appears:

1. That to take a great lading with respect to its size, it ought to have a great breadth and depth, in proportion to its length, and to be full in the bottom. Such a ship would also work with a small number of hands in proportion to its cargo. But it would neither sail well nor beat to wind-ward.
2. That to give the property of sailing and beating to windward, to the end that it might beat off a lee shore, as well as come about well in a hollow sea, the ship must necessarily have a considerable moment of stability in proportion to the plane of resistance, that it may be able to carry a press of sail notwithstanding a strong wind; with this view it is necessary to give the ship in question, great breadth in proportion to its length; to fill it much towards the load water-line, curtailing it in the bottom. Such a ship would require a numerous crew because of the largeness of the sails, and the weight of its anchors.
3. That if it be required to navigate a ship with few men, in proportion to the lading, it should have a small surface of sails, and anchors of small weight. For this purpose it should have little breadth in proportion to its length. It would also be enabled to carry a great lading, in proportion to its equipment of men, by giving it great fullness in its bottom [flat bottom]; but such a ship would sail badly close to the wind and would come about with difficulty in a hollow sea.

The Ronson ship appears to have been a compromise of Chapman's qualities. She probably held a large amount of cargo per length and crew size, sailed reasonably well to beat off a lee shore, carried a press of sail in a strong wind, and carried less ballast than some other ships of her size. These properties were accomplished with the ship's great breadth-to-length

ratio (1-to-3.4), full bottom, full upper bow, and her long keel (compared to other full-bodied cargo ships). The longer keel offset some of the poor sailing properties of the flat bottom. Though the Ronson ship's master may have wanted to sail with more than a minimum crew, to enable them to fight off small privateers and pirates, the ship's full bottom provided enough space to allow a good cargo tonage-per-man ratio for economy. In addition, the flat bottom required less ballast because the shape of the hull lessened its tendency to heel. In theory, the Ronson ship was an exceptionally good compromise.

Whether the Ronson ship type of hull continued to be built for a number of years is not clear from either the ship or contemporary documents. Since the shape of each frame was designed before construction, the ship could have been standard, an experiment, or a prototype. If the ship had been built by rack-of-eye, one might assume that it was a traditional hull. However, some documentary evidence does imply that more ships were constructed to a similar design. A Captain Stevens in 1748 stated, "In time of war, ships are built sharp, and in time of peace, full [referring to the shape of the the midship cross section]... most ships are now built in such a manner as to take the ground loaded", i.e., flat-bottomed.<sup>16</sup>

Captain Stevens' statement may be a possible clue to the historical milieu at the time of the Ronson ship's creation. Although not as full as those of the flyboats, which plied safer waters than the Western Atlantic, the Ronson ship was fairly full. Stevens' statement therefore implies that the ship was built in time of peace, possibly after the War of Spanish Succession, which ended in 1713, and before the War of Jenkins' Ear, which began in 1739.

The actual method used by eighteenth-century naval architects to design a ship has not been known. In fact, each naval architect may have used a different method. In order to

discover the method used by the Ronson ship's designer, I decided to compare the hull's shape with that derived from the known methods. As noted above, Anthony Deane described a geometric method of designing a warship in 1670. An anonymous author (c. 1620), Sutherland (1728), and Murray (1754) described similar methods, but did not go into as much detail.<sup>17</sup> Chapman (1768) did not describe how to create the shapes of the frames.

To develop a ship plan, Deane started with a side view of the ship (See Figure 23). He drew a selected length of keel (AB), then drew the shape of the stem's rabbet (where the outer plank ends met the stem) by setting a compass at  $\frac{3}{4}$  the maximum breadth of the ship and drawing an arc tangent to the forward end of the keel. Deane determined the rake of the stempost (BC) to be  $\frac{11}{72}$  of the maximum breadth. Further geometric manipulations allowed him to draw a straight loaded water-line and an arc of large radius to determine the sweep of the lower wales and deck.<sup>18</sup>

After determining the shape of the ship when viewed from the side, Deane developed a cross section of the midships frame (See Figure 24). In Figure 24 the line EF represents the "height of [maximum] breadth," which is approximately the loaded waterline. Below EF the shape of the hull was created by a flat floor from B to H, H being  $\frac{1}{3}$  of the distance from B to A. The sweep from H to L is centered at K, which is  $\frac{1}{2}$  the distance AB directly above H. Deane then set his compass at  $\frac{7}{9}$  ths of the last distance, made that the distance from E to M, and drew the sweep from E to N, with its center at M. The sweep from L to N had a radius of  $\frac{20}{36}$  of the maximum breadth, with its center at O, but Deane did not record the exact position of O, N, and L. Above the maximum breadth, at E, he drew the tumble home of the hull by placing a new sweep's center outside the hull.

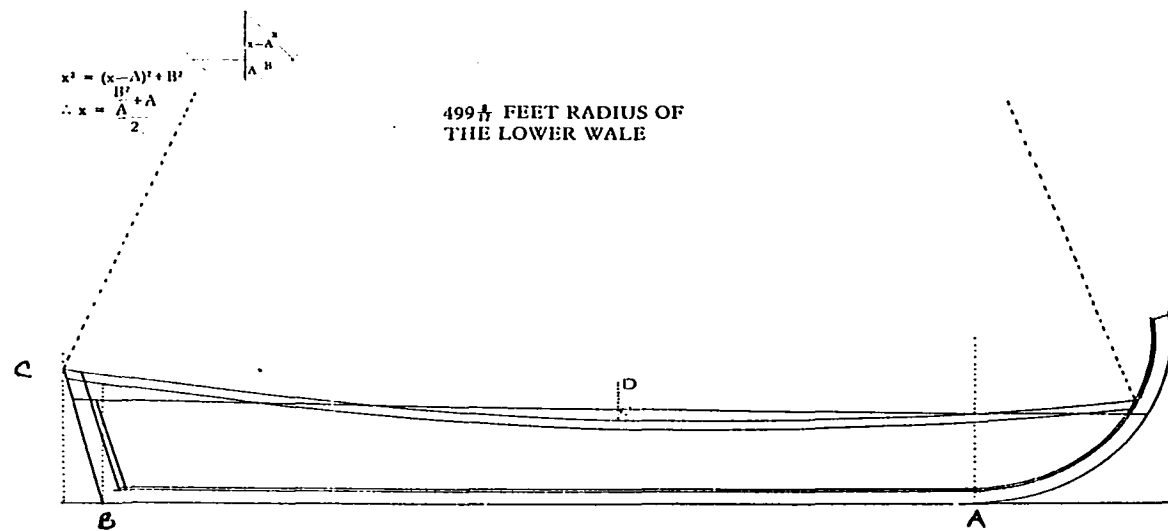


Figure 23. Deane's method of designing the side view of a warship, 1670. From Lavery, DEANE'S DOCTRINE, 57.

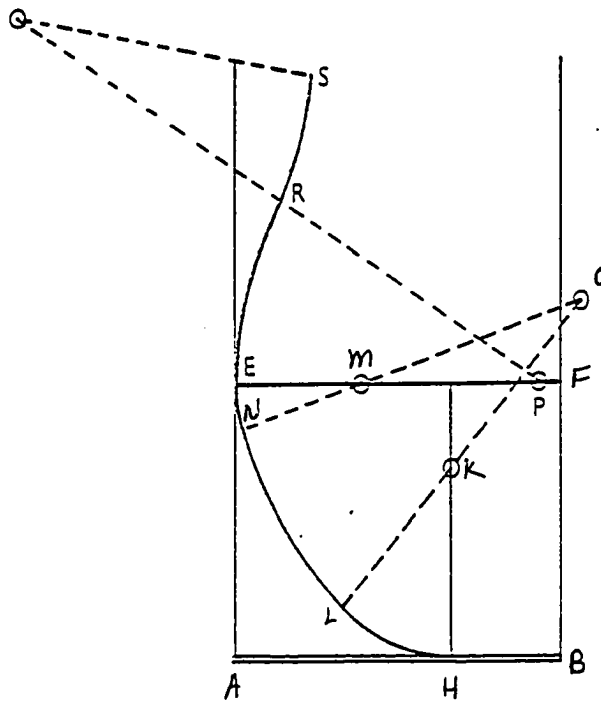


Figure 24. Deane's method of designing a cross section of a warship. From Lavery, *Deane's Doctrine*, 69.



As discussed earlier, the Ronson ship probably was designed on paper before construction. But did the ship's designer use a geometric technique similar to Deane? The method Deane described creates a ship's cross section and side view that are combinations of simple arcs and straight lines. Determining straight lines on a drawing of part of the Ronson ship was simple. However the method of determining if a curve was part of a circle, and finding its center and radius, puzzled me. Maclean Shakshober, a retired naval architect, showed me a method he had developed to study the hull cross sections of HMS *Mary Rose*. Using his method I measured the Ronson ship's midships station and drew a series of lines perpendicular to the outline of the hull, representing possible radii of sweeps. I discovered that the lines crossed at three distinct points inboard of the ship (See Figure 25). These three points correspond in principle to those described by Deane, but they are in different positions from Deane's. It appears that the designer used the same geometric principle described by Deane, but used different fractions in his equations to determine the lengths of his straight lines and the centers and radii of his sweeps. By redrawing Deane's midship section with different fractions for the sweeps, one can arrive at a shape like the measured Ronson ship midsection (See Figure 26).

Since the Ronson ship's cross sections appeared to be designed using the geometric system, George Matson, a retired naval architect who spent many days analyzing the ship's hull, wondered if the shape and size of the stem were also as described by Deane. Deane drew his stem rabbet as one large arc which met the keel and continued up approximately ninety degrees to vertical. Since the stem was undergoing conservation treatment at the time, Matson and I rolled out the 14-foot one-to-one tracing of the stem onto The Mariners' Museum patio. We found that the stem rabbet described approximately ninety degrees of a 16-foot (4.8 m.) arc (See Figure 27). In addition, though Deane did not suggest doing so, Matson found that the breast hook, which horizontally crossed the stem to tie both sides of the

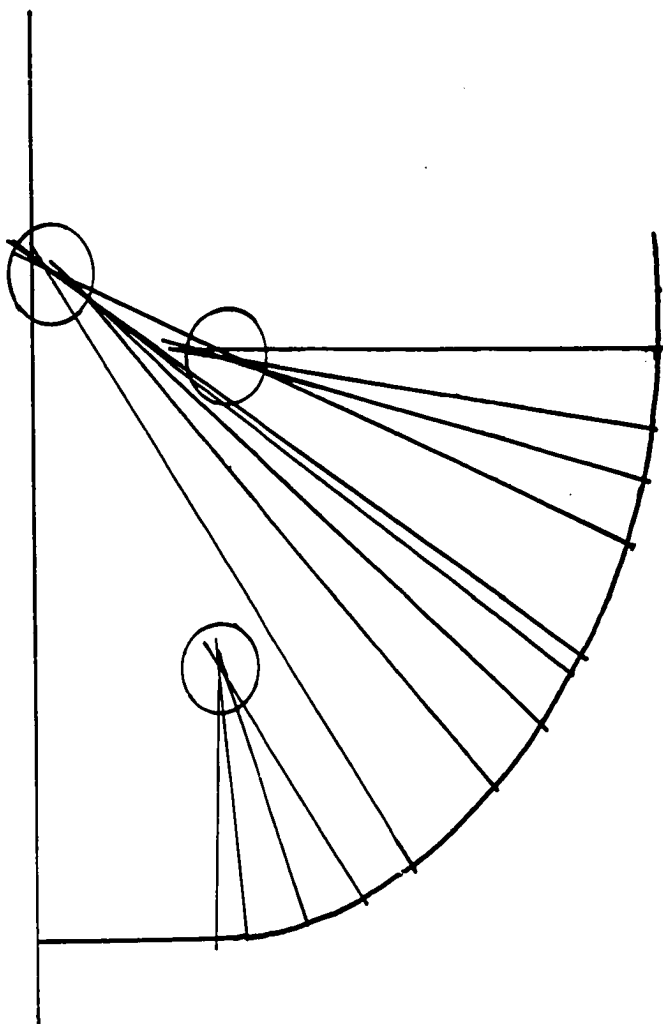


Figure 25. Testing the architect's use of arcs on the Ronson ship's midship section.  
(W. Riess)

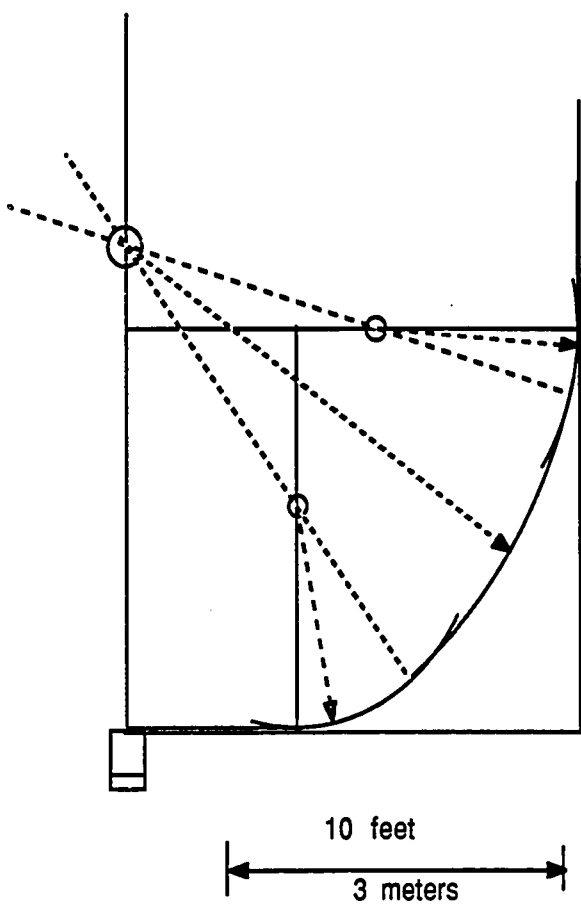


Figure 26. Using the geometric method to design the Ronson ship. (W. Riess)

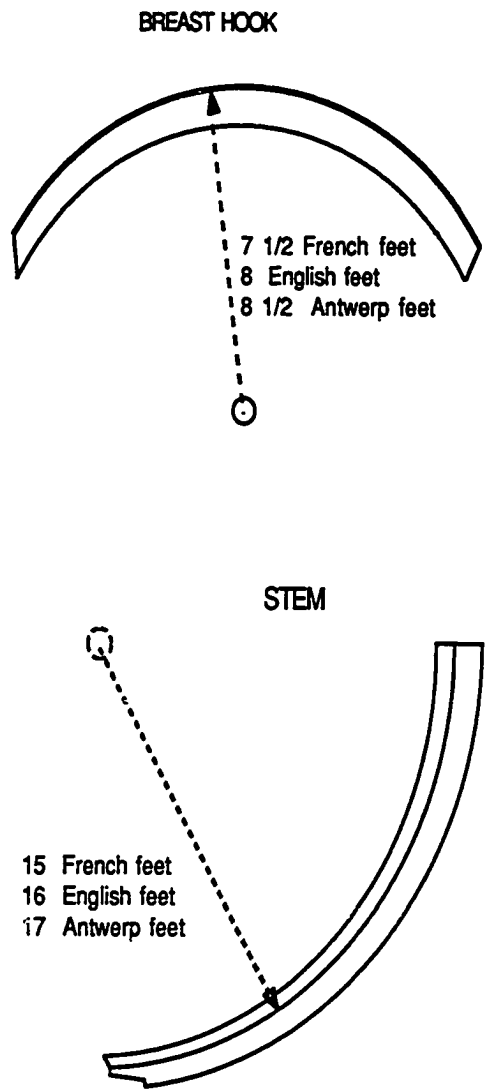


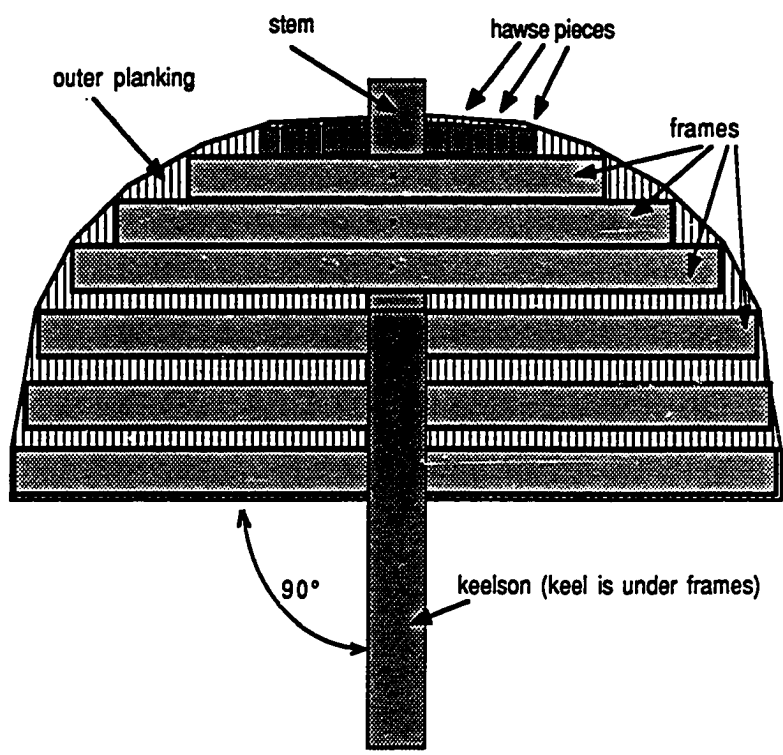
Figure 27. Measuring radii of arcs for the stem and breast hook.  
(W. Riess)

same geometric method to define all the three views of the hull, but used different fractions of bow together, described a horizontal 8-foot (2.4 m.) arc where it lay against the bow frames. The Ronson ship's architect therefore used the keel's length to determine the positions and radii of the sweeps.

Remains of the Ronson ship imply that the geometric method of ship design was used throughout the period since Deane published the geometric method in 1670, the Ronson ship was constructed ca. 1730, and Sutherland and Murray described the same method in 1726 and 1754. Because the Ronson ship provided different radii fractions than Deane for the geometric method, and Sutherland and Murray recorded no fractions for the technique, the four sources imply that various proportions were used for different ships. However, one must be cautious about conclusions based on three treatises and only one physical example.

The ship's remains also offered information about the development of the bow framing in wooden ships. The Ronson ship's bow, which was moderately bluff, required frames to form an intermittent surface shaped to allow side planking to turn inward to end at the stem. The proper shape could be accomplished using either cant or square frames, but the builder chose to use square frames. Square frames were perpendicular to the keel, like the midships frames. To accomplish the proper form near the stem, bow square frames had to be placed up the stem apron and the final space near the stem filled with hawse pieces (See Figure 28). The inner surfaces of square frames needed to be drastically beveled to provide a surface for the planks. Bow square frames provided little support by themselves against wave shock on the bow. The and the hawse pieces were therefore reinforced with chocks and massive breasthooks to form a bow of almost solid timber.

Cant frames simplified the transition from fore-and-aft sides to the stem by being at an



NOT TO SCALE

Figure 28. Square frames and hawse pieces in bow construction.  
(W. Riess)

angle to the keel. The angle systematically changed from 90 degrees toward 0 degrees as they were nearer the stern (See Figure 29). Since the cant frames supported the bow against wave shock, they allowed a lighter timbered bow for the same strength. Their cross section was almost rectangular, therefore the builder could use timbers with less cross section than those for square frames, saving money and available timber.<sup>19</sup>

The lack of cant frames in the ship is important when considering the development of hull construction. Although cant frames have been used on ships since the third century B.C., sometime around the eleventh century A.D., as large ships developed, shipwrights also began to use square frames.<sup>20</sup> By the mid-eighteenth century, only cant frames appear in literature and ship remains. In 1935 Howard Chapelle, studying the development of American ships, placed the reintroduction of the exclusive use of cant frames between 1650 and 1750.<sup>21</sup> However, the Ronson ship, probably built between 1705 and 1720, represents the latest evidence for the continued use of square frames. Thus, the ship is evidence that the dates for the elimination square frames are further narrowed to between 1705 and 1750.

The fact that the Ronson ship was designed by drafting the ship with simple sweeps and straight lines and the incorporation of square, rather than cant, frames reflects the continuation of an earlier ship design tradition. However, whereas surviving treatises, and other archaeological remains, indicate that eighteenth-century warship architects had switched to using cant frames in the bow, the designer of this merchantman continued to use square frames for the bow. It is not clear whether this was because of strictly traditional forces, or because the availability of timber made square frames more practical.

Though surviving treatises indicated that the geometric method was used to design warships of the period, the Ronson ship's remains are the first indication that merchant

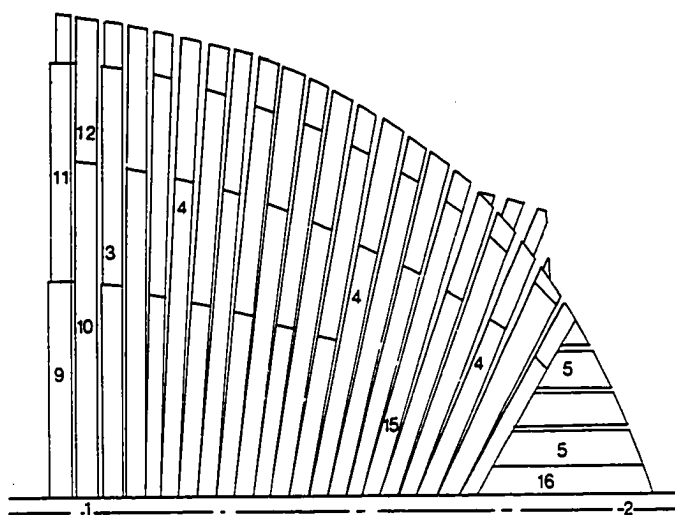


Figure 29. Typical bow cant frames. From Brian Lavery, *The 74-Gun Ship BELLONA* (London, 1985).



ships were also designed by this method. The use of fractions that were a little different from those used by Deane probably reflect some of the differences between Deane's warships and merchantmen. The shape of the ship, which appears to be a successful combination of the British frigate and Dutch flyboat, suggests an answer to some questions about the means by which British merchantmen became more efficient in the eighteenth century. However, generalizing further about major trends in ship design is not appropriate, for this ship is only one example. We must await the discovery and study of other merchant ships from the period.

## NOTES, CHAPTER FOUR

1. Mungo Murray, *A Treatise on Ship-building and Navigation* (London, 1754), 133. William Sutherland, *The Shipbuilder's Assistant* (London, 1726), 59-60.
2. Wescott Abell, *The Shipwright's Trade* (London, 1948), 35. William A. Baker, *Colonial Vessels: Some Seventeenth-Century Sailing Craft* (Barre, Mass., 1962), 20.
3. Fernand Braudel, *The Structure of Everyday Life: Civilization and Capitalism, 15th-18th Century*, Volume I (New York, 1981), 431.
4. Sutherland, *Shipbuilder's Assistant*, 60-61. Murray, *Ship-building*, i-iii.
5. Author's personal observations, 1969-present.
6. Brain Lavery, *Deane's Doctrine of Naval Architecture, 1670* (Greenwich, England, 1981).
7. Sutherland, *Shipbuilder's Assistant*, 77-78.
8. Murray, *Ship-building*, 133-136.
9. Braudel, *Structures of Everyday Life*, 431.
10. Lavery, *Deane's Naval Architecture*. Fredrik Henrik af Chapman, *Architectura Navalis Mercatoria* (New York, 1968 [orig. publ. Stockholm, 1768]).
11. Arthur P. Middleton, *Tobacco Coast: A Maritime History of Chesapeake Bay in the Colonial Era* (Baltimore, 1984), 120, 137.
12. Ralph Davis, *The Rise of The English Shipping Industry in The 17th and 18th Century* (Newton Abbot, England, 1972), 286-288.
13. Chapman, *Architectura Navalis*, plate 3. Models in The Mariners' Museum, Newport News, Virginia: *Royal Sovereign*, ca. 1804 (84.72) and *Vesuve*, ca. 1726 (MD34).
14. Ralph Davis, *English Shipping*, 71.
15. Chapman, *Architectura Navalis*, 83-84.
16. House of Commons Journals 1745-50, 761-765--as found in Davis, *English Shipping*, 74.
17. Murray, *Ship-building*, 135. William Salisbury and R.C. Anderson, eds., *A Treatise on Shipbuilding and A Treatise on Rigging Written About 1620-1625* (London, 1958). Sutherland, *Shipbuilder's Assistant*, 50-69.
18. Lavery, *Deane's Naval Architecture*, 52-58.

19. Sutherland, *Shipbuilder's Assistant*, 35. Peter Throckmorton, personal communication, 1987.

20. J. Richard Steffy, personal communication, 1987.

21. Howard Chapelle, *The History of American Sailing Ships* (New York, 1935), 67. Murray, *Ship-building*, 154. Sutherland, *Shipbuilder's Assistant*, 66-67, 75.

## Chapter Five Career as a Merchantman

The transportation of goods and people throughout the eighteenth-century British Empire was vital to the establishment, existence, and expansion of the empire. The British empire was developed to increase the wealth and security of the English. Their actions toward the colonies were based on profitable trade, the emigration of undesirables, and military needs. Shipping provided the means to explore, conquer, and settle new territory in the seventeenth and eighteenth century. As the empire developed, the English used ships to bring desired goods from the colonies to Britain for local consumption and reexportation at a profit. In exchange, they usually sent out processed supplies and manufactured goods. Military vessels, and sometimes merchantmen, often were used to expand and protect the ports and sea lanes from foreign navies, privateers, and pirates.

The transportation of goods, people, and information within the empire was conducted primarily on merchant vessels of many sizes and designs. Transatlantic merchantmen like the *Ronson* ship left the British Isles for America with explorers, settlers, soldiers, food supplies, and manufactured items. They usually returned nine months later with some return passengers and lightly processed cargoes such as mast stock, naval stores, tobacco, indigo, and iron ingots.

Without developed industries, the American colonists produced mostly foodstuffs, tobacco, and timber products. They consumed the majority of products within their respective colonies and shipped some to other colonies specializing in other products.

However, in order to buy necessary finished goods, such as tools and glass, from other parts of the British Empire or foreign countries, the colonists had to ship some of their products overseas, where American foodstuffs, tobacco, and wood were in high demand. It is important to remember that Anglo-American colonists considered themselves citizens of the British Empire. They were British subjects, used British standards of measurements and money, and were protected by, and subject to, the British Navigation and Admiralty Laws.

Transatlantic voyages were profitable when successful, but they were not easy for merchants in the eighteenth century. Raising the necessary capital, fitting out one's ship, hiring a good crew, and acquiring a cargo in America were only the first problems to face. Sailing to Britain, or other countries in Southern Europe, often took three months of hard work. The Atlantic Ocean of the early and mid-eighteenth century was not a friendly ocean for British merchantmen. Bad weather and disease were two natural problems which often worked against the voyage, sometimes destroying the ship, crew, and cargo entirely. Pirates, privateers, and enemy cruisers were almost a constant danger in the eighteenth century. When the ship neared its destination it was in danger of being wrecked on shore by weather or mistakes in piloting. In a European port the cargo was unloaded and sold, the ship resupplied, and an west-bound cargo loaded. The process took approximately two months. Then the ship sailed west through similar problems as before and arrived in America to start the process again.

There were many variations to this simple tale. The owner of the ship might invest in a cargo or a ship could be hired by a merchant to carry a specific cargo at a price for the voyage. Ships also were owned by companies which had monopolies in a particular trade. Some, such as the tobacco ships which sailed between Britain and Chesapeake Bay, often sailed in convoy, protected by a navy cruiser. When a profitable cargo was not available for

a leg of a journey, captains would weight their ships with rocks or sand and sail "in ballast" to another port. Though most transatlantic ships sailed a shuttle route, repeated round trips between two ports, some followed a multi-port pattern, while others tramped from port to port as they saw an opportunity for greater profits or less danger. Generally, profit was the major motive which guided the ship owners – costs and danger were their enemies.

During the eighteenth century, shipping and distribution costs steadily dropped in comparison to initial production costs of the goods transported. The drop in relative transportation costs was due mostly to an increase in port storage facilities, an increase in the size and weight of packaging, an increase in trade, and the destruction of most pirate enclaves. The development of port storage facilities and the increase of size and weight in packaging brought a great reduction of port time for ships and of inventory costs for the merchants. These in turn, made it possible for some ships to make two, instead of one, round trip across the Atlantic per year. The increase in trade and destruction of pirate enclaves increased the information about current markets and decreased losses and insurance rates respectively.<sup>1</sup>

According to Shepherd and Walton, after these changes transportation and distribution costs were halved from 1675 to 1775, while production costs increased by fourteen percent. The new ratio of transportation to production costs promoted regional and social specialization in the empire. For example, in the American colonies British manufactured goods often were better and cheaper than those produced in the colonies, while colonists were able to deliver agricultural products to British markets cheaper than British farmers. As American overseas trade grew, it fostered an increase in America of settlements, domestic trade, employment, stock capital (mostly tools), dissemination of knowledge, immigration of trained people, and transfer of capital. All of these, in turn, increased maritime trade.<sup>2</sup>

The Ronson ship was an active participant in these major changes in the western world.

In Chapter Two I hypothesized that the Ronson ship was a 170-ton merchantman (or 260 tons if registered in Britain) built in Virginia c.1730. Accepting this hypothesis, I reconstructed a typical round trip voyage for this type of ship based on archival material and new evidence from the ship's remains. Although one can not be certain about a voyage for the Ronson ship until it is eventually identified, this exercise is helpful when interpreting the new evidence found at the 175 Water Street site.

Most ships of the Ronson ship's size that were built in the Chesapeake in the early eighteenth century were constructed for the tobacco trade. They were usually built for or sold to English merchants, who provided most of the transatlantic transportation for tobacco.<sup>3</sup> A contract between builder and future owner could have been signed before the ship was built, although builders sometimes speculated by building a ship and advertising to sell it before and after it was completed. The *Virginia Gazette* includes numerous advertisements of ships for sale between 1731 and 1750. Ships were often delivered after launching, when the hull was finished but the ship's hardware was not yet rigged.<sup>4</sup>

When the ship was ready for service, a crew was hired to man her. The number of men was a balance reached by the owner between economy and perceived needs. All ships needed at least a minimum crew to work all the sails of the three masts in two watches (crews that stood four-hour watches together). More men were needed to man guns and repel boarders in dangerous waters, handle more sails in a fast ship, and to man the pumps in a leaky ship.<sup>5</sup> Since the Ronson ship moved through the Western Atlantic, a relatively dangerous area, she would have required more than a minimum crew if not for the convoy system. An analysis of the Virginia Naval Shipping Lists between 1727 and 1730 (when the number of men were

recorded) indicate a mode of twelve men manned American made vessels the size of the Ronson ship.<sup>6</sup>

A typical crew of twelve men included the master (captain), mate, boatswain, cook, cooper, four able bodied seamen, and three or four ordinary seamen. The latter uncertainty exists because the naval officers did not record whether the "number of men" included the master. The master navigated and ruled the ship. He sometimes transacted business for the owners or consignees of the cargo. Often the captain was an owner or part owner of his ship and cargo. The mate, second in command, was responsible for one of the watches and management of the crew. He might also serve as quarter master, helping the master with the administration of the ship. The Boatswain guided the crew in maintaining the ship's rigging and hardware and might also serve as ship's carpenter to maintain the hull, masts, and the ship's other wooden fixtures. The cooper repaired or constructed any casks needed at sea and while at port. Able seamen were well experienced, while ordinary seamen still required more training.

Once the crew was hired the master calculated the amount of ballast which would be needed to make this ship sail properly with a full load in the eastward journey. He had to consider many factors in his calculations, including the ship's draft, shape, and rigging, weather to be expected, and the cargo's weight and density. After the crew loaded the ballast into the hold they could begin to load their east bound cargo. In the early eighteenth century most ships of more than 100 tons left the Chesapeake with tobacco for London. Tobacco was a fragile commodity, prone to damage when handled or transported by wagon along America's poor roads.<sup>7</sup> Since inter-Chesapeake transportation of tobacco was expensive and dangerous for the cargo and a shallow draft ship, like the Ronson ship, could navigate up most rivers in the Chesapeake, few entrepot cities developed in the Chesapeake. Instead, the ships typically



traded at large plantations, picking up tobacco on consignment to a London merchant.<sup>8</sup> The consignment deals often were transacted by factors for the English tobacco merchants before the ship was ready to load. After the 1730 Virginia Inspection Act, tobacco had to be inspected before it was shipped. The number of inspection stations limited the number of shipping places for the ships to go, therefore the stations became distribution centers. At the plantations and some of the inspection stations the crew typically could not bring the ship over the shallow oyster flats which extended a quarter mile out from the shore. The ship's and plantation owner's small boats were used to row casks of tobacco to the ship's side. There, each cask was hoisted up and into the ship's hold using the main mast, a spar as a boom crane, and a capstan or windlass. In contemporary illustrations and present rigging practise, casks were lifted horizontally using a doubled loop sling or barrel hitch (See Figure 30).

Tobacco was generally shipped in hogsheads (pronounced "hogs 'hids" in Virginia today), which were wooden casks made of staves, two heads, and wooden hoops. They varied in size, depending on their contents, origin, and date. Tobacco hogsheads in Virginia were standardized in 1695 at inside dimensions of 46 inches (101 cm.) high by 30 inches (76 cm.) diameter at the heads, or outside dimensions of 48 inches (122 cm.) high by 35 inches (90 cm.) diameter at the bilge (bulge in the middle). Their capacity was 148 gallons (562 liters). Tobacco, like most commodities in the eighteenth century was sold by the pound, but because it was light for its volume, a ship's capacity for tobacco was limited by space, not weight. This required the ship's owners to charge by volume rather than by weight. Since tobacco was sold by the pound, and transportation costs were by volume (hogshead), shippers gradually learned to pack more tobacco into the casks by a pressing technique which did not harm the tobacco. Thus a typical hogshead contained 600 pounds (270 kilograms) of tobacco in the seventeenth century and 650 pounds (293 kilograms) of tobacco in 1724.<sup>9</sup>



*Denna Förm byggs i Göteborg  
för ost Indiska kompaniet 1748.*

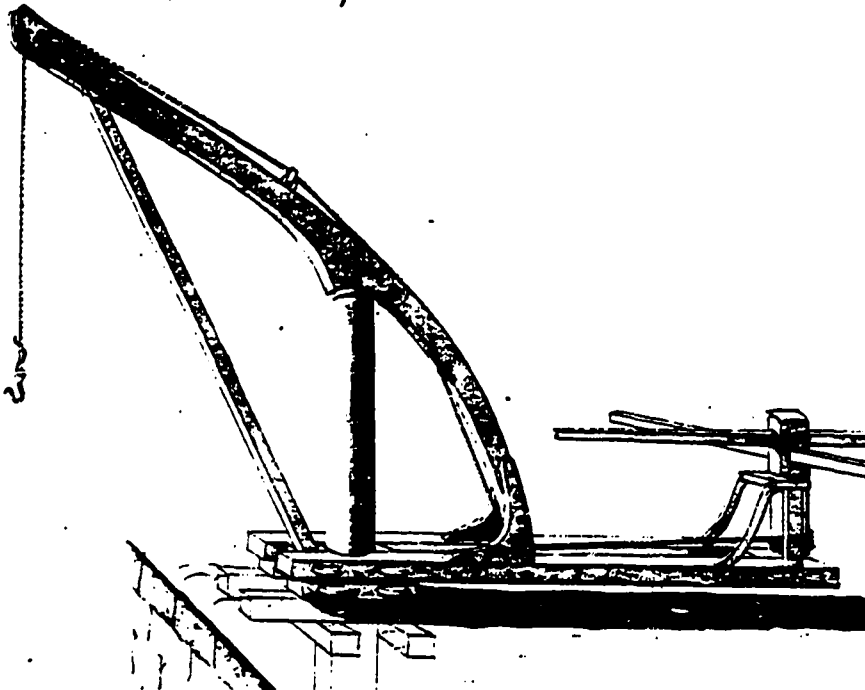


Figure 30. Moving casks in the eighteenth century. A: Using a doubled loop sling, from the Fry and Jefferson "Map of Virginia and Maryland, 1751," Courtesy of The Mariners' Museum. B: A 1748 Swedish dock-side boom crane, using a mast butt or pile as a fulcrum and a capstan for lading cargo. From the Chapman Collection, courtesy of the Swedish Maritime Museum.

The main and forward cargo hatches on the Ronson ship were rectangular, 4 feet by 6 feet (1.2 by 1.8 m.) for the main hatch and 4 feet by 5 feet (1.2 m. by 1.5 m.) for the forward hatch, with their long dimension running fore-and-aft. This means that the hogsheads could easily be lowered into the hold horizontally and longitudinally, implying that they were also stored that way. This technique of stowing seems to have been standard in the Western world. The earliest evidence is the remains of the 1565 Basque whaling ship excavated at Red Bay, Labrador.<sup>10</sup> Schooner captains still used the same stowing method, "bilge and cantline," in the twentieth century.<sup>11</sup>

Since tobacco had to be kept dry in the voyage, hogsheads on the bottom layer of the hold were probably stowed "bilge free," that is, they rested on small pieces of wood or broken cask staves to keep their bilges off the ceiling planking. The sand ballast was pushed between the lower hogsheads to keep them from shifting.<sup>12</sup> Each layer above the first was staggered both fore-and-aft and athwart ships so that the bilge of each cask fit into a hollow formed by the hogsheads' ends in the lower layer (See Figure 31). They were probably chocked with either broken cask staves, triangular chocks, or tree limbs, such as found on the Red Bay, Yorktown (YO88), and *Defence* ship sites respectively. Spaces at either end of the hold, formed by the shifted tiers of hogsheads, were generally filled with other, smaller cargo. The Virginia Naval Office Shipping Lists show that most of the ships carrying large cargos of tobacco also carried many smaller casks and wood products, such as cask staves.

The hull's shape, height of the decks, and position of the hatches provide information about the distribution of cargo in the hold. Knowing the space required for the cargo allows the determination of space remaining for other uses and weight distribution in the vessel.

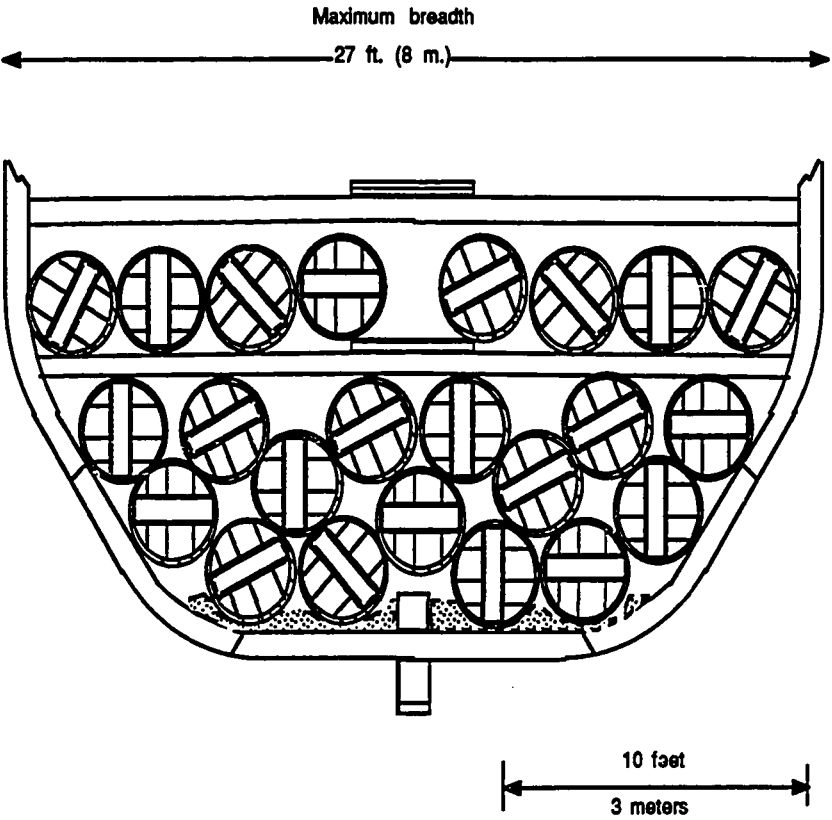


Figure 31. Cross section of the Ronson ship, showing probable layout of hogsheads and ballast. (W. Fliess)

These in turn, allow the determination of the amount of ballast required for the ship to be stable and some sailing characteristics of the ship.

In order to determine the space required for the Ronson ship's typical cargo, one must first determine the number and size of casks it would carry. To do so I considered data taken from the Virginia Naval Office Shipping Lists from 1699 to 1704. To arrive at a typical lading for a southern colonial built ship, I analyzed the cargo-to-registered tons ratio for these ships between 160 and 200 tons inclusive. Almost all of the ships' main cargos were hogsheads of tobacco. Arriving at a figure of 2.9 hogsheads-per-ton, I multiplied it by 160, the calculated American registered tonnage. Using this method I concluded that a typical American-built ship registered at 160 tons would have carried 464 hogsheads of tobacco. These cargo capacity figures are estimates based on the assumption that the Ronson ship's shape was at least close to a typical southern colonial-built merchant ship of her time.

To determine the distribution of the 464 hogsheads in the ship, The Mariners' Museum's Ronson ship research team constructed a crude, one-to-forty-eight model which represented the ship's hull. It included located bulkheads, rose box around the mast and pump, decks, and hatches. We also made model hogsheads to the same scale. By physically placing the casks in the model ship we were able to place all of them in three layers in the main hold and one layer between decks, laying on the lower deck (See Figure 32). In the 44-foot (15 m.) long main hold the cargo space was limited forward by a bulkhead we located 10 feet (3 m.) aft of the stem. Forward of the bulkhead, in the port bow, we discovered a tar brush, wooden tub, and pulley block pieces lying on the ceiling planking. Similar collections found on the *Defence* and YO88 indicate that the boatswain's supplies in British and American ships were commonly stored in the port bow.<sup>13</sup> Another bulkhead is

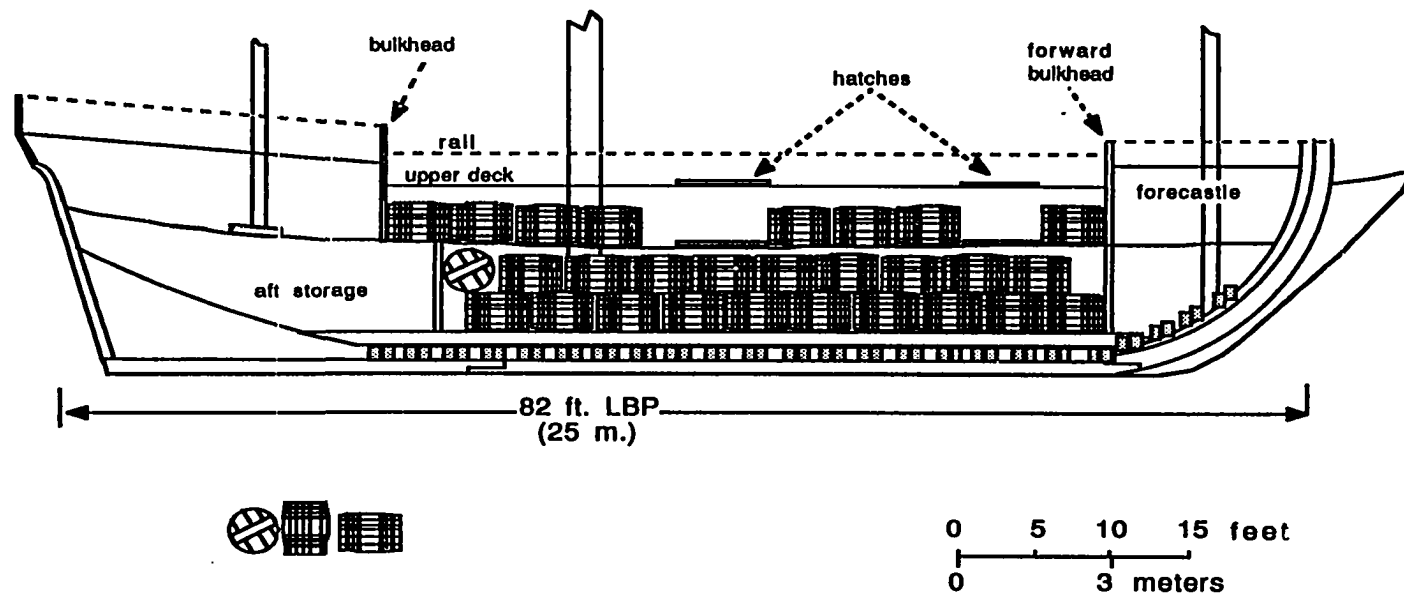


Figure 32. The Ronson ship, side view with hogsheads.  
(W. Rless)

presumed 8 feet (2.4 m.) aft of the main mast because we found pine paneling in the aft section, providing evidence to support the tradition of munitions and provisions storage areas aft of the main mast.<sup>14</sup> However, during the field work we were not able to excavate the area where we hypothesized the bulkhead existed, because of possible danger from a cave-in. Between decks, the remaining casks filled a space from 10 feet forward of the mizzen mast to ten feet aft of the stem.

Six six-pounder cannon stood in the after section between decks. In addition, the captain, mate, and quarter master traditionally quartered in the stern. The only remaining area for crew quarters was in the forecastle and among the ordnance. The forecastle was traditionally the gathering and feeding compartment for the crew, yet we found no cook stove there. Perhaps it had been on the upper deck and was removed when the nineteenth-century basements were constructed in that space. It appears that the forecastle also served as the berthing area, though quartering and eating between the guns, aft between decks, was common on war ships. No material recovered from the site provided positive evidence for the location of the crew's quarters. Their quarters were probably determined more by the stowage of the cargo to keep it safe and help the ship sail properly (See Figure 32).

Once the cargo was in place the master checked the trim of his vessel, usually by being rowed around it in still waters. A comparison of bow and stern draft marks, numbers marking every foot up from the keel's bottom, helped the master determine the ship's fore-and-aft trim. Draft marks were found carved on the Ronson ship's bow, but we could not determine if they also existed in the stern. When the crew made any necessary changes in trim by shifting the cargo and ballast, the ship would be ready for its transatlantic voyage. At that stage the master reported his imminent sailing with the local naval officer. He was not an officer in the Royal Navy, but a clerk of the Naval Office who represented the

governor in local shipping matters. He inspected the ship's papers, granted a certificate of clearance and recorded information about the ship, crew, and cargo in the Naval Office Shipping Lists. The following information was recorded for the merchantman *Sarah and Mary* by the naval officer on March 27, 1727:<sup>15</sup>

Cleared at the York District [at Yorktown, Virginia]

Time of clearing - March 27, 1727	Ship's name - <i>Sarah and Mary</i>
Of what place [registered port] - London	Master's name - "Ja <sup>s</sup> Lane"
Kind of build - Square [sterned] ship	Tons(registered) - 200
Guns - [ left blank, possibly zero]	When & where built-Mattapanay [Va.] 1726
When & where registered - Virginia, 1726	Owner's name - Humphrey Nell [?]
Whether bound - London	When & where bond given-York,March1746

Cargo Exported:

663 hogsheads of tobacco  
 1400 pipe, 2400 hogshead, and 2200 barrel staves  
 2 pipes of wine [possibly re-exported from Madiera]

Four times a year the naval officer submitted a copy of his lists to the colonial governor, who forwarded them to the Board of Trade or the Treasury in London.<sup>16</sup> There the reports from all naval offices and customs agents were compared to insure that ships were conducting their trade within the bounds of current navigation laws. For example, the London records were checked to see that the *Sarah and Mary* actually arrived in London within a reasonable time with the Chesapeake tobacco, staves, and wine. If the ship arrived back in the Chesapeake after a few months without showing in some other British port's records, with a different cargo, it might mean the master had taken the ship and tobacco to a foreign port illegally.



At approximately the same time as registering with the naval officer, and obtaining a certificate of clearance from him, the master notified the Royal Navy that the ship was ready to be convoyed to Britain. Typically the annual Chesapeake convoy left for Britain in May, but it often left in June or July. By that time the previous year's crop of tobacco had been harvested, processed, packed, and loaded on board the merchant ships. A May sailing also allowed the ship to exit southern waters before hurricane season and the spawning season of the destructive teredo ship worms. The convoy normally included 150 to 200 merchant ships and one or more Royal Navy frigates to protect them. As they left Chesapeake Bay the ships stayed close to each other for protection from raiders and for assistance from the others in case of other problems.<sup>17</sup>

When at sea, the soundness of the ship's structure and the method of rigging, ballasting, and lading her would be put to the test by the North Atlantic. The design of the Ronson ship provided for a ship which should have carried her cargo well at sea, though not at any great speed. Details of the ship's construction show a carefully made tight ship, even with the ceiling planking caulked to keep the cargo hold dry. Discovering how the ship handled at sea necessitated some specialized expertise. George Matson, a retired naval architect, and Bill Ackiss, a ship designer volunteered to analyze the lines of the ship in order to suggest its sailing qualities.

Knowing the shape and size of the Ronson ship's hull, placement and size of the masts, and cargo size and distribution, Matson and Ackiss will determine the best amount of ballast for the ship's trip east. The ballast would have consisted of local sand or of discarded foreign ballast stone, coral, or sand left on the beach by some other ship. It was placed on the ceiling planks in the hold.

If the ship's master ballasted and trimmed the ship properly she would have been a fairly good sailor. The flat floors gave her a stability which allowed the crew more time to adjust sails in sudden weather changes and still survive most North Atlantic storms. With proper handling the crew could take advantage of light or stiff winds from aft or either side of the ship. Sailing into the wind would have been impossible, but she would have sailed closer to the wind than the flyboats.

Life aboard would have been busy for the crew. In order to keep expenses low, merchant ships carried as few men as possible. They therefore had much to do in their three months at sea in order to keep the ship maintained and safe. Though there were only a few men in the crew, cargo, passengers, and supplies took most of the available space in the ship. Just as written records suggest, there was little room for the crew except in the forecastle, between the guns (if passengers did not have that area), on the deck, and in the rigging. A recent study suggests that eighteenth-century crews felt the crowding and expressed their individuality by purposely wearing different clothes and identifying their few possessions with their initials or marks.<sup>18</sup> The spirits bottle found under the officer's quarters suggest that someone on board drank alcohol and the broken clay pipes which had been smoked suggested that someone smoked. However, not enough other artifacts were found from the ship's sailing years to give any real clues to the crew's lifestyle.

Upon reaching London the crew secured and unloaded the ship. Usually the cargo already belonged to a British merchant who would have the cargo placed in a warehouse for sale or export to the continent. The owner would search for a return cargo by advertising or employing a shipping agent. The ship was loaded and the west-bound journey would begin after the ship cleared customs.

The west-bound cargo was more varied than the goods coming from America. Manufactured articles including tools, luxuries, processed foods, and servants were in demand in the colonies. Because of their diverse nature the naval officers usually only listed them as quantities of "goods from Great Britain." Virginia merchants' newspaper advertisements were more explicit:<sup>19</sup>

**Just** Imported, from London by William Hooper, and to be Sold by him, at his Store, (which was formerly Mrs. Archer's) in Williamsburg, the following Goods, viz. Broad Cloaths of all Sorts; Druggets, Duroys, German Serges, Kerseys, Camblets, Sagatbees, Duffils, Scarlet Ditto, with suitable Trimmings for them, of Gold, Silver, or Plain. Velvets of several Colours, to match any Pattern. Alopeens, Shagreens, Brocades, Mantua Silks, Flower'd Silks, Starrets, Paduasoyes, and Jeans. Manteels, Manteelers, Velvet Hood; Capes ready made of Velvet, or Black Silk, with a very fashionable Snail, Black, Scarlet, or Mix'd Colours: Or, if any Persons would rather buy the Goods, they may have very fashionable Patterns given them, with Directions how they should be made.

All Sorts of Goods for Mourning, both for Men and Women: Also Hats, Wiggs, Stockings, Shoes; Haterdashery, Cutlery, &c. If any Gentlemen or Ladies have a Mind to have Suits of Cloaths, or Stays, made of any of the above-mentioned Goods, they shall be cheaper served than ever, and made by the best Workmen from London. He also sells New-Market and Great Coats, ready made. For any of Which, they may pay in Bills, Cash, or Tobacco: And if any Persons have Tobacco to dispose of for Goods, (with some Money,) let them apply to the said William Hooper, who will deal as Reasonable as any Man. If any Gentlemen are desirous of having Suits of Cloaths made up in England, they may have them done according to their Directions, by applying to the said Hooper, without any further Trouble, and on Reasonable Terms. Any Person who is inclinable to deal for a Parcel of Goods, to the Value of Three or Four Hundred Pounds, may be supply'd very Cheap, for Tobacco, to be paid Time enough to be sent Home by this Year's Ships.

Since the ratio of the value of cargo to its volume was generally higher for west bound goods than for east bound goods, ships tended to carry less volume of goods west than east. If

they carried the same volume both ways, America would quickly become glutted with European goods. In order for the ships to sail correctly when only partially loaded with goods, the crew needed to weight the ship down by adding ballast. In eighteenth century London ships generally were ballasted with beach stone and flint. Unfortunately, the naval office shipping lists provide no data to determine a typical amount of cargo and ballast for a merchantman like the Ronson ship because they did not record the quantity of English goods coming into the colony. In order to sail well with a limited amount of cargo, the crew would have loaded more ballast into the hold before loading the return cargo.

After loading the ballast, cargo, and provisions for the crew, and clearing with customs, the ship joined the yearly convoy back to the Chesapeake. Depending on the weather and political situation, the convoy would either take the southern or northern route across the Atlantic. The southern route was preferred in the seventeenth century because of the ease of navigation by following the clockwise trade winds to the Azores, Caribbean, and up to the mainland colonies. However, the length of the journey, southern insect-borne diseases, pirates, enemy cruisers, and privateers made the southern route dangerous. As time and increased trade brought more knowledge of the possible routes to America in the eighteenth century, most British merchantmen took the northern route, past Iceland, Greenland, Nova Scotia, and south to the other colonies. Though the northern weather could be harsh at sea, many of the dangers associated with the southern route were reduced in the North.<sup>20</sup>

Upon reaching the coast off Chesapeake Bay the convoys often were forced to wait until the winds and tide were right to enter the Bay. Shifting sand bars made the entrance hazardous unless the weather and timing were correct. Some of the problems associated with a wait outside of the bay were depredations by pirates, storms arriving to drive the ships ashore, and circular tidal currents which could also drive a ship on shore. Once the convoy made its

way into the Chesapeake each ship went to its destination within the bay, after stopping to receive a certificate of entry from the nearest naval officer. Then the cargo would be unloaded and either given to the waiting merchants and plantation owners who already owned the goods, or advertised and sold at wholesale and retail prices by the ship's master or a London merchant's factor (who could also be the captain).<sup>21</sup>

After unloading the cargo, the crew unloaded the excess ballast, usually on shore where the colonists wanted some fill or where it could be picked up easily by themselves or others when needed. Most of the crew were paid off, to find another job or wait without pay for another trip on the same ship. A minimum port crew was often retained to protect and clean the ship while shore based crews might provide maintenance and repairs to the hull and rigging. Then the ship was prepared for a new cargo of American exports for the return trip.

This round trip, from the Chesapeake to London and back, appears to have been common for the transatlantic ships of the early eighteenth century. The naval office shipping lists and the Virginia Gazette both show most transatlantic ships making annual trips between one area of the Chesapeake and one port in Britain. Occasionally such a ship would digress to another port, and some ships did not keep the pattern, but most maintained a yearly shuttle route. After the Act of Union in 1704, especially after 1720, there was a steady increase in the percentage of ships which sailed to Scottish and West Coast English ports, rather than to London.<sup>22</sup>

As stated at the beginning of this chapter, although the archival and archaeological data indicate the Ronson ship probably was a Chesapeake-built ship trading between London and the Chesapeake, many other possibilities exist. Her design and construction probably made her a good ship for trading in most areas of the Atlantic, however most ships in the early

eighteenth century that fit the information we have accumulated for her were sailing east with tobacco from the Chesapeake and west with British goods from London.<sup>23</sup>

The amount of cargo per registered ton on this ship was probably as high as possible for the conditions in the North Atlantic in the eighteenth century. The fact that the ship sailed well with a maximum cargo and minimum crew spoke well of the ship's design. Life at sea could not have been very comfortable for the busy crew, who had little space for themselves. Yet life must have been better on board the merchantmen than on the warships, whose sailors were often pressed from merchant ships.

Wear marks and repairs to the ship indicated that she sailed for a number of years before being buried in Manhattan. How, or why the ship finished its sailing career in New York is not clear. Some of the ships entering and clearing the harbor in the eighteenth century were southern-built ships. Some of them frequented New York, while others only visited once. The Ronson ship's last voyage into New York Harbor may have been as a regular merchantman, a chartered supply ship for the crown, or as a prize of war. In either case she was probably condemned as unfit for sailing and the decision was made to use the hulk to extend the waterfront into the East River.

## NOTES, CHAPTER FIVE

1. James F. Shepherd and Gary M. Walton, *Shipping, Maritime Trade and the Economic Development of Colonial North America* (Cambridge, 1972), 73-90.
2. Shepherd *et al.*, *Shipping*, 60, 157-161.
3. Arthur P. Middleton, *Tobacco Coast: A Maritime History of Chesapeake Bay in the Colonial Era* (Charlottesville, Virginia, 1953), 254, 355. P.R.O., C.O., Virginia Naval Office Shipping Lists (N.O.S.L.), 1699-1747.
4. Joseph A. Goldenberg, *Shipbuilding in Colonial America* (Charlottesville, Virginia, 1976), 82-86, figure 9.
5. Fredrik Henrik af Chapman, *Architectura Navalis Mercatoria* (New York, 1968 [orig. publ. Stockholm, 1768]), 86.
6. Ralph Davis, *The Rise of the English Shipping Industry in the 17th and 18th Centuries* (Devon, England, 1972), 73. P.R.O., C.O., Virginia N.O.S.L., 1727-30.
7. Middleton, *Tobacco Coast*, 212.
8. Middleton, *Tobacco Coast*, 104, 109, 353.
9. Middleton, *Tobacco Coast*, 113 and Chapter 4 reference note 33.
10. R. James Ringer and Michel J. Audy, "Cargo Lading and Ballasting on the 16th-Century Basque Whaling Vessel *San Juan* (1565)," *Proceedings of the 13th Conference on Underwater Archaeology* (San Marino, Calif., 1984), 20-22.
11. Author's personal observations at the *Defence* and Yorktown YO88 sites. Personal communications with Peter Throckmorton.
12. Ringer and Audy, "Cargo Lading," 24-26.
13. Author's personal observations.
14. William Sutherland, *The Shipbuilder's Assistant* (London, 1726), 75. Author's personal observations at the *Defence* site.
15. P.R.O., C.O., Virginia N.O.S.L., York District, March 27, 1727.
16. Walter E. Minchinton, "Introduction," P.R.O., C.O., Virginia N.O.S.L.
17. Middleton, *Tobacco Coast*, 313-320.
18. Sheli O. Smith, *The Defence: Life at Sea as Reflected in an Archaeological Assemblage from an Eighteenth-Century Privateer* (Ph.D. dissertation, U. of Penn., 1986), 209, 212.

19. *The Virginia Gazette* (May27-June 3, 1737), 4.

20. Middleton, *Tobacco Coast*, 8.

21. Middleton, *Tobacco Coast*, 119-122, 148. *Virginia Gazette* (May27-June 3, 1937), 4.

22. P.R.O., C.O., Virginia N.O.S.L., 1699-1747.

23. This conclusion was a consensus reached at a symposium on the Ronson ship held on March 5, 1986 at the National Maritime Museum, Greenwich, England. Attending were: David Lyon, Alan Viner, Alan Pearsall, John Munday, Roger Morriss, Alan Stimson, Teddy Archibald, Chris Daniel, Reginald Varrell, Peter Van Geersdale, Roger Prentice, and Peter Van der Merive, all of N.M.M., and from outside N.M.M., Brian Lavery, David MacGregor, David Roberts, John Franklin, Michael Jeisen, Kurt Raveh, Jonathan Adams, Martin Dean, Robert Cembrola, and Warren Riess.



## Chapter Six Development of 175 Water Street, Manhattan

The National Westminster Bank presently occupies a thirty story office building at 175 Water Street in New York City. The building completely covers a small city block which once held the remains of the Ronson ship. Though the land appears stable enough to support the 350-foot high steel building, until the mid-eighteenth century the block did not exist. The historical and archaeological investigations of the Ronson ship site allow a close look at the era in which the block was created and the method used to develop the land surrounding Manhattan.

The Island of Manhattan is a hilly granite outcrop, covered with good top soil, and tucked into a glacially scoured trench which formed the Hudson River and New York Harbor during the last ice age period. Manhattan is approximately ten miles long and one mile wide. It forms the east bank of the mouth of the Hudson River, the west bank of the East River (actually an estuary), and the south bank of the Harlem River, a branch of the Hudson. For millennia the island was almost surrounded by shallow mud flats (See Figure 33).

To seventeenth-century Europeans, Manhattan was a natural bastion from which one might control water transportation in the region. Its fertile, hilly terrain offered reasonable farming and good residential property. The land was surrounded by water, which offered fish for food and hindered infantry attacks, yet it was protected by Long Island and Staten Island from the direct assault of ocean waves and surprise water-borne attacks. Manhattan's ten-mile western shore- line, which formed the southern-most east bank of the Hudson

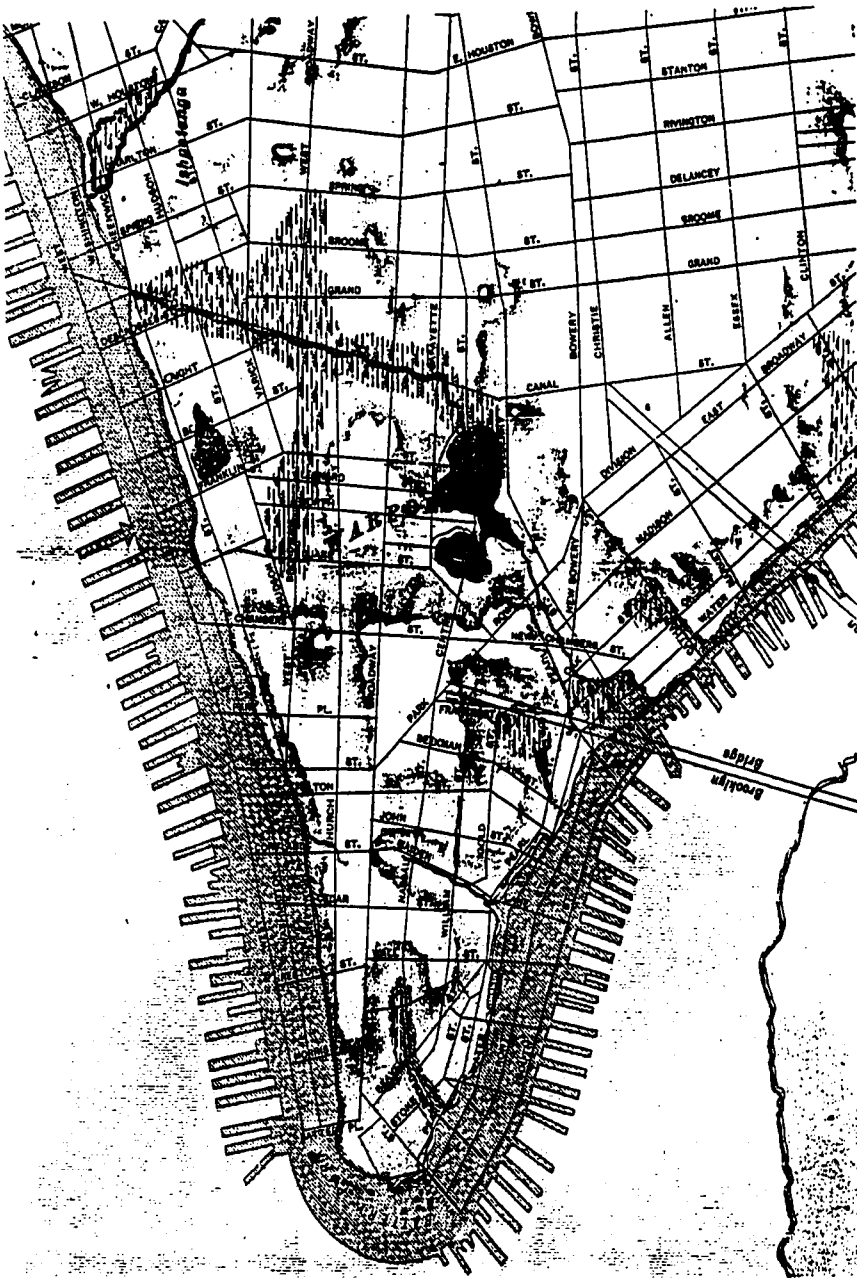


Figure 33. Original configuration of Manhattan, with modern streets and fill shaded. From Townsend MacCown, "1609, The Island of Manhattan at the Time of its Discovery."

River, allowed almost complete control of water access to the vast hinterland served by the river. Small vessels could move cargo from the upper regions of the river system to Manhattan, or shippers might transfer their cargo at Albany to ocean-sailing ships, which could navigate that far. In either case, whoever held Manhattan controlled the hinterland. In addition, as the European colonies developed, New York was central to the colonies. Coastal trade between the middle colonies could be protected or harassed by government or private warships operating out of the harbor.

Water transportation access to the ocean was through one of two natural channels. The safer passage was south between Staten Island and Long Island, then close to Sandy Point (New Jersey), and out into the Atlantic Ocean. The other passage ran up the East River, through the narrows and Hell Gate between Long Island and the mainland, into Long Island Sound, and eventually out into the Atlantic around the eastern end of Long Island or nearby Fishers Island or Block Island.

Manhattan Island sits just north of the fortieth parallel, yet its proximity to the Atlantic Ocean provides comfortable weather throughout most of the year. The growing season is approximately five months, plenty of time to grow one planting of most American and European crops in the fertile soil. Winters are mild, offering ice-free conditions in the deep harbor through most, but not all, winters.

The combined effects of weather, soil, position, and surrounding waterways made Manhattan one of the most promising spots for the development of a European trade settlement in the seventeenth century. Only the mud flats surrounding the island, which held large ships approximately 200 yards (180 m.) off the shore, kept it from being a perfect natural trading port for transatlantic ships.

Although previous explorers had found Manhattan, the first significant European contact with New York was the entrance into the lower bay of Henry Hudson's *Half Moon* on September 12, 1609. Hudson was searching for the elusive Northwest passage for the Dutch East India Company. In his report he mentioned the possibility of fur trading with the local natives, but the Dutch East India Company was concentrating on the Asian trade so they did not pursue his suggestion.<sup>1</sup> The incorporation of the Dutch West India Company in 1621 provided the collective funds in 1624 to establish a trading settlement at Orange (now Albany) along the Hudson River. Two years later, the company established the settlement of New Amsterdam on the southern tip of Manhattan island.

The Dutch West India Company's main interest was trade with the native population. To this end their choice of Manhattan was excellent. The large island was at the mouth of a large, navigable river which provided both native and Dutch transportation for a large hinterland abundant with furs. Transatlantic Dutch vessels could enter and sail from the entrepot without much difficulty. All of these factors allowed for relatively inexpensive transportation of furs, and later agricultural products, from the interior of America to the company's warehouses in Europe.<sup>2</sup>

Although the Dutch sent families, rather than just men, to the new settlement, it was not to be similar to the English settlements in New England. While English settlements quickly grew into heavily populated colonies, Manhattan remained a fortified trading post throughout most of the seventeenth century. During their control of the island, the Dutch spent much of their collective efforts on fortifications and other municipal construction endeavors. They paved only one street, aptly named Stone Street, yet they made substantial improvements to the harbor facilities. The Dutch built piers, constructed retaining walls at the high water mark to stop erosion around the town, and filled behind the walls to establish a low quay which

almost surrounded the southern end of the island. Apparently, the Dutch used a crib of horizontal logs secured by vertical piles at the quay. Whether they were anchored with "dead men" logs is not clear (See Figure 34). Cargoes were moved from and to ships by scows (flat-bottomed boats) or directly from small vessels which could beach close to the quays at high tide or navigate a creek at what is now Broad Street. In 1658 they constructed a large dock at the southeastern shoreline, to accommodate small to medium sized ships (See Figure 35).<sup>3</sup>

On September 8, 1664, the Dutch surrendered New Amsterdam without a fight to a powerful British squadron. Except when the Dutch regained control for almost a year in 1673-4, the city remained British until the American Revolution. Under the rule of British Governor Edmund Andros, the New Yorkers – a mixture of Dutch, English, and other national origins – expanded the city's trade and port facilities. Among such improvements was a new stone city dock which was completed in 1675. Manhattan's commercial role continued to be the trading station for New York's interior with Europe and the West Indies, the majority of trade slowly shifted from the export of furs to that of flour, other agricultural goods, and timber products. New milling and bolting (sifting) laws added quality control to the flour export trade, enhancing it greatly while the fur trade played a smaller, but still strong, role.<sup>4</sup>

In the early eighteenth century, New York was still a small port with only a sparsely populated hinterland to produce surplus goods and buy imports. However, its flour and wood products were in demand overseas, especially in England and the British West Indies. New York exports in the eighteenth century included beaver pelts, whale oil, and some tobacco to England and flour, bread, peas, pork, and horses to the West Indies. Imports included

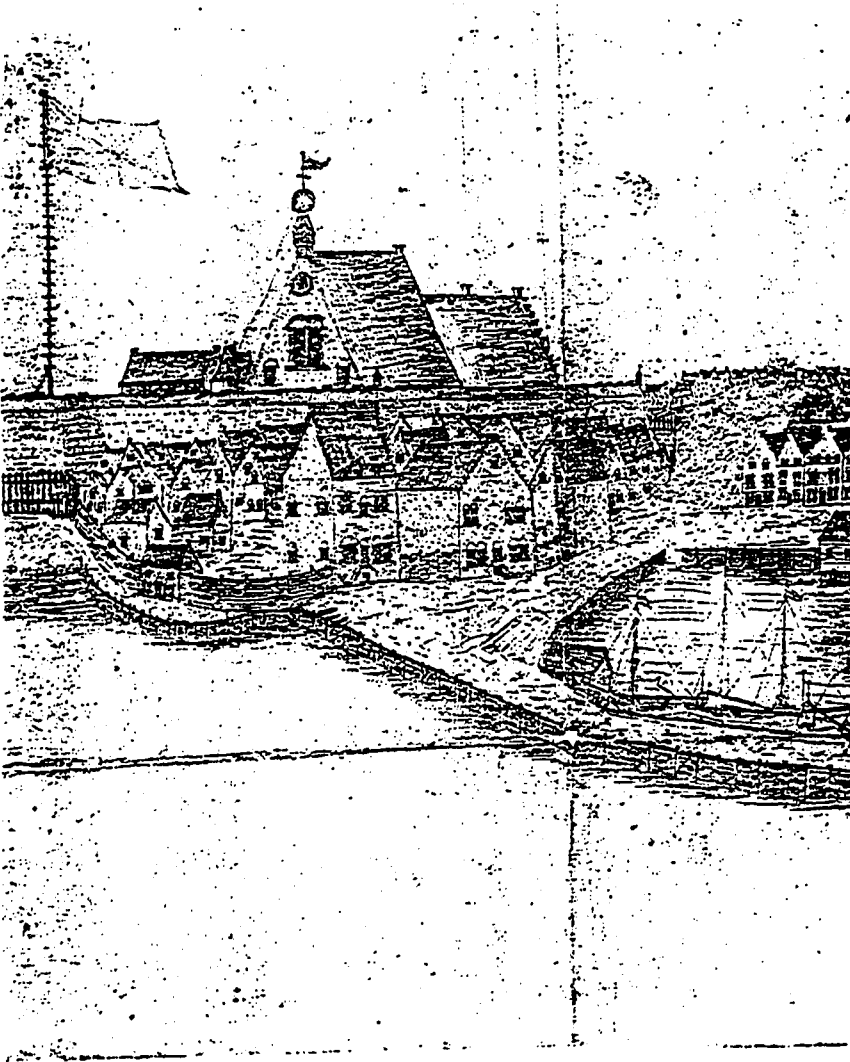


Figure 34. A view of Manhattan in the Dutch period, c. 1679-1680. Note the log cribbing at the high tide line. From "The Labadist General View," Issac N. Stokes, *Iconography of Manhattan*, 1498-1909 (New York, 1915), plate 17.

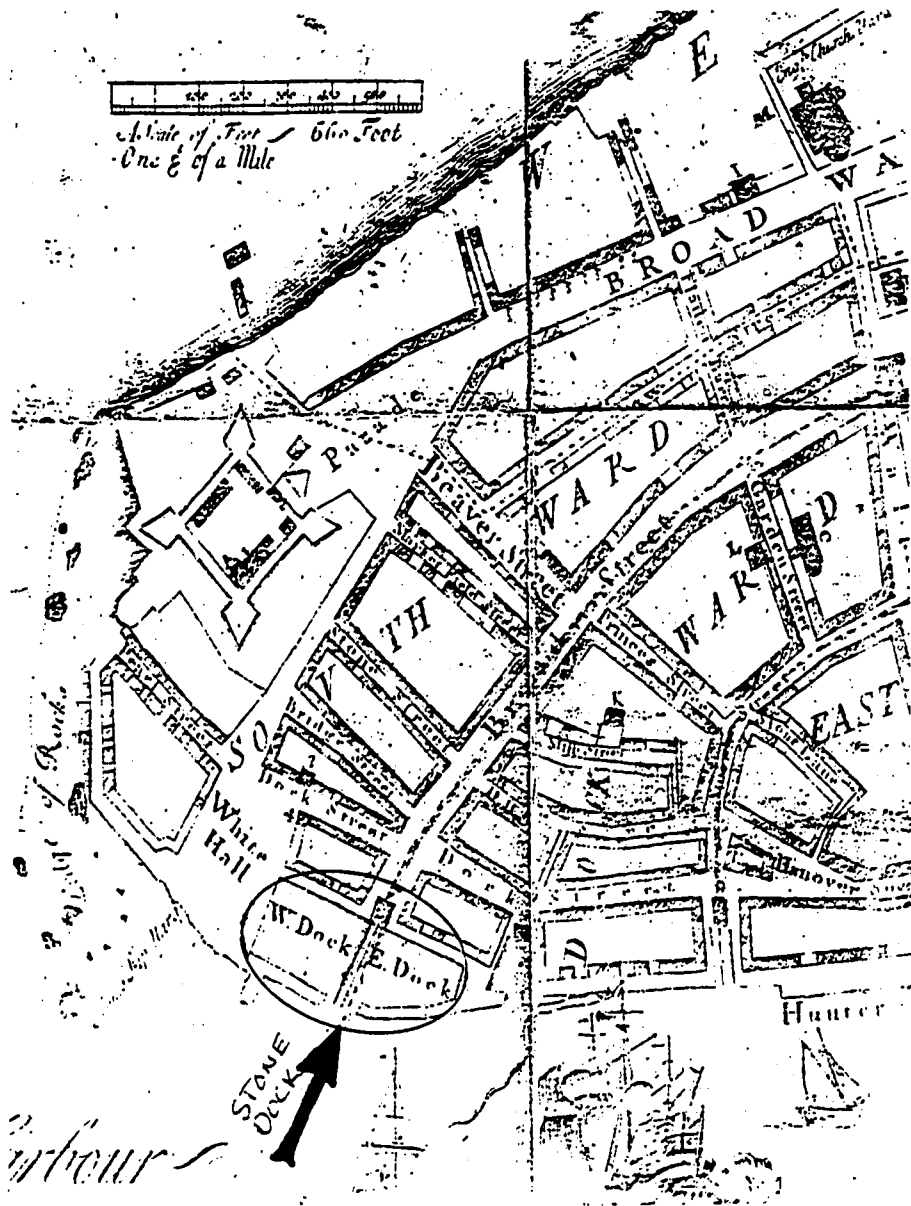


Figure 35. The Stone Dock was constructed on the Southeast shore to accommodate medium and large vessels. From Issac N. Stokes, *The Iconography of Manhattan Island*, 1498-1909 (New York, 1915), plate 27.

manufactured goods from England and rum, molasses, and sugar from the West Indies. Some trade was also conducted with the Iberian Peninsula and wine islands for salt and wine as per the legal exception to the British trade laws.

The eighteenth century brought a major increase in shipping activities. In 1716 a visitor recorded, "a fine quay ... reigns all around the town, built with stone and piers of wood outside. There are small docks for cleaning and building small ships. At high water, the vessels come up to the quay to lade and unlade."<sup>5</sup> By 1720 New York's hinterlands had established themselves enough to produce significant amounts of export goods. The port expanded accordingly, as did its need for larger, more economical commercial ships. Colonial New York port records show that prior to 1720 few merchant ships entering the port were registered at over 100 tons. But in the next few years the larger ships became more common.<sup>6</sup> Since New York possessed a good harbor centrally located in the thirteen colonies, it also was used by the British as an important military terminal.<sup>7</sup> A 1717 view of New York, from the Brooklyn Heights, shows many merchant and war ships anchored in the East River (See Figure 36).

Port facilities needed to grow to meet the increasing demands of commerce. Larger ships could only meet the shore at the stone dock, which was too small to service all the ships. Many of the vessels, moored in the harbor, were still serviced by lighters, flat-bottomed boats which could sail over the flats to a quay or slip. In order to service the ships efficiently, the colonists needed to expand their harbor facilities out into deeper water. The Dutch had previously raised the land above the high water mark. By filling the intertidal and shallow subtidal areas of the shoreline to the street level, the eighteenth-century colonists could load and unload trading vessels directly from wagons, cutting out the extra steps of loading cargo into lighters, moving the lighters, and unloading the cargo from lighters.



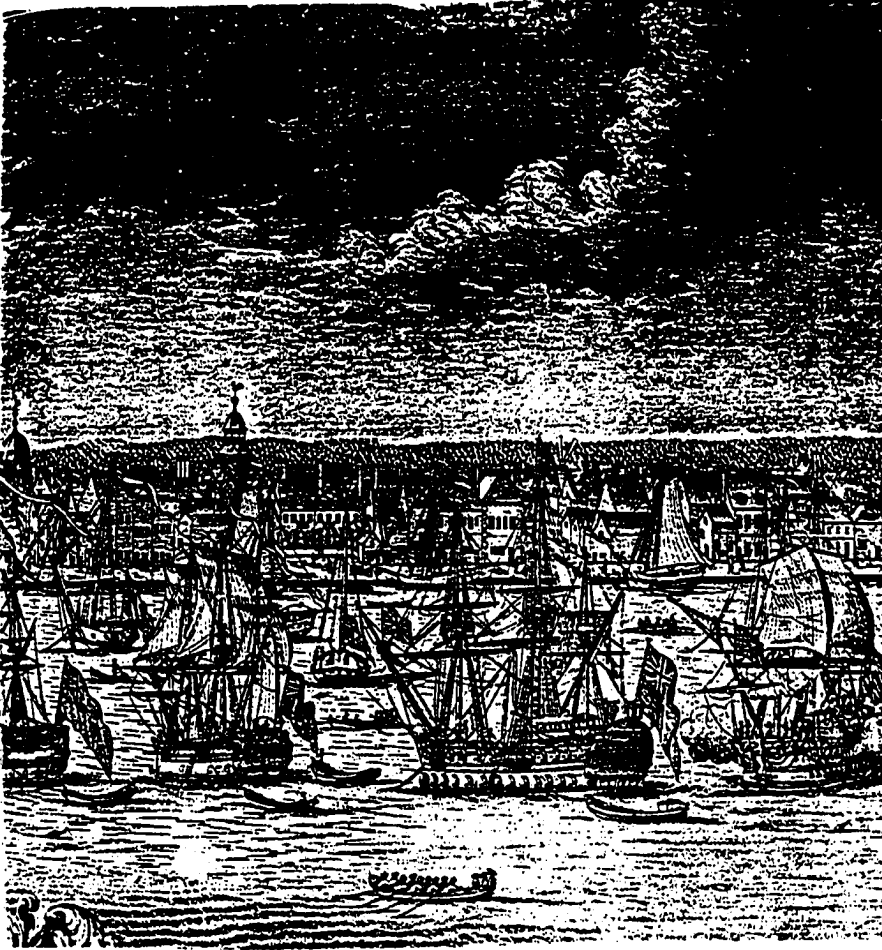


Figure 36. A view of New York, c. 1717, from Brooklyn Heights, by William Burgis.  
From Issac N. Stokes, *The Iconography of Manhattan Island, 1498-1909*  
(New York, 1915), plate 25.

Extending the shoreline was an organized affair. The city government continued to issue a deeds for each water lot, usually to the person whose land came to the shoreline at that lot. The agreement generally included the stipulation that the lot be filled within a specified number of years and that a municipal street be included along the newly created shoreline or quay. Lots were then cribbed with an interlocking structure of logs and were filled with stone, soil, and refuse from the land, and excess ballast from visiting ships. When an old ship was available, it might be incorporated into the lot as a substitute for other forms of cribbing the fill.<sup>8</sup>

The original high water Manhattan shore line of the East River was built up by the Dutch to form Queen's Street, now Pearl Street (See Figure 37). By 1730 the English had filled water lots out one block to the old low water line, from Pearl Street out to what became Water Street, for approximately two miles north from the Whitehall Battery at the southern tip of the island.<sup>9</sup> The new construction meant that water was always lapping against the new quays. At Burnets Key, between Wall and Crown Streets, the colonists had already filled out another block's width to allow approximately 12 feet (3.6 m.) of water at high tide and 8 feet (2.4 m.) of water at low tide. This was enough water to allow a 300-ton ship to dock at high tide. At low tide a ship of 100 tons or more would lie aground. Between the new blocks formed by the filling processes, slips were left to accommodate lighters at the various markets. Each slip evidently had its own specialty market, such as the Fish Market, Meat Market, Meal Market, and Fly Market (another meat market) (See Figures 38).

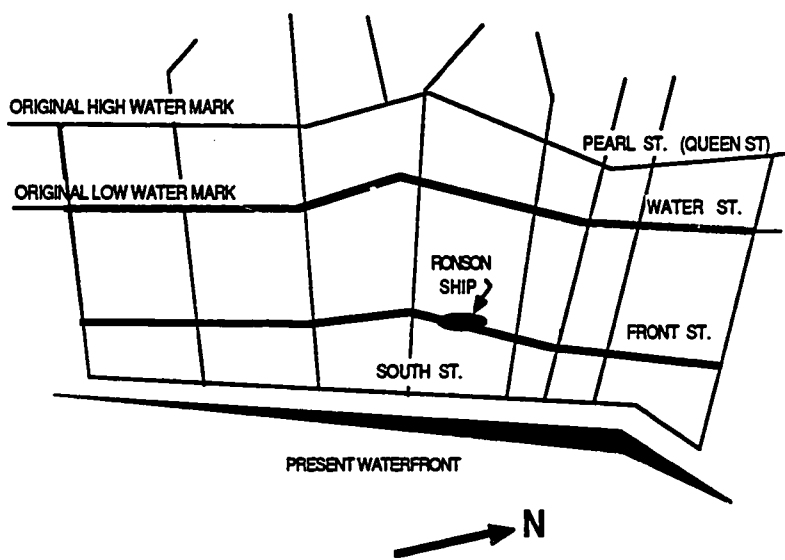


Figure 37. Sketch showing the original high and low tide lines near 175 Water Street.



Figure 38. A 1756 view of the East River and the New York waterfront. From Issac N. Stokes, *The Iconography of Manhattan Island*, 1498-1909 (New York, 1915), plate 35.

In 1813 seventy-six year old surveyor David Grim recorded the use of the New York slips in the mid-eighteenth century:

Those slips were formerly openings between two wharves, in the river, for horses and carts to enter, and there unload the wood boats; those boats would go into the slips at high water, and ground there, for the cartmen to enter from Pearl Street, in order to unload them. I have often seen, at high tides, the water, by way of those slips, in Pearl Street.<sup>10</sup>

With continued commercial growth the waterfront between Fletcher Street and Burling Slip (also "Lyons Slip," now John Street) quickly became an important piece of property in the 1730s. It was situated just upriver of the Fly Market and bordered the newly developing upper section of the port. A wharf area, which became Water Street, directly bordered the river at the low tide line. Along the west side of the street were homes and commercial buildings which looked out at the busy harbor. In the late 1730s the owners of the homes and commercial buildings applied for water lot grants for the east side of Water Street, across from their respective land lots. That land was to become 175 Water Street (See Figure 39).

A charter of 1731 gave the city authority to grant water lots out to 400 feet (120 m.) beyond the low water mark.<sup>11</sup> The nine grantees between Fletcher and John Streets were required to extend the width of Water Street to 45 feet (13.5 m.), construct another 40-foot (12 m.) -wide wharf or street 200 feet (60 m.) out over the East River, and fill the area between the street and wharf for their own use within ten years. Evidently five of the lot owners, those of lots number two through six, coordinated their efforts to crib the fill for the deep end of their lots with an old merchant ship (See Figure 38).<sup>12</sup>

All of the five water lots which eventually contained this ship were granted in 1737. Lot two was granted to James Alexander and Archibald Kennedy. Although little is recorded of Kennedy, except for his dealings through Alexander, records show that Alexander was a

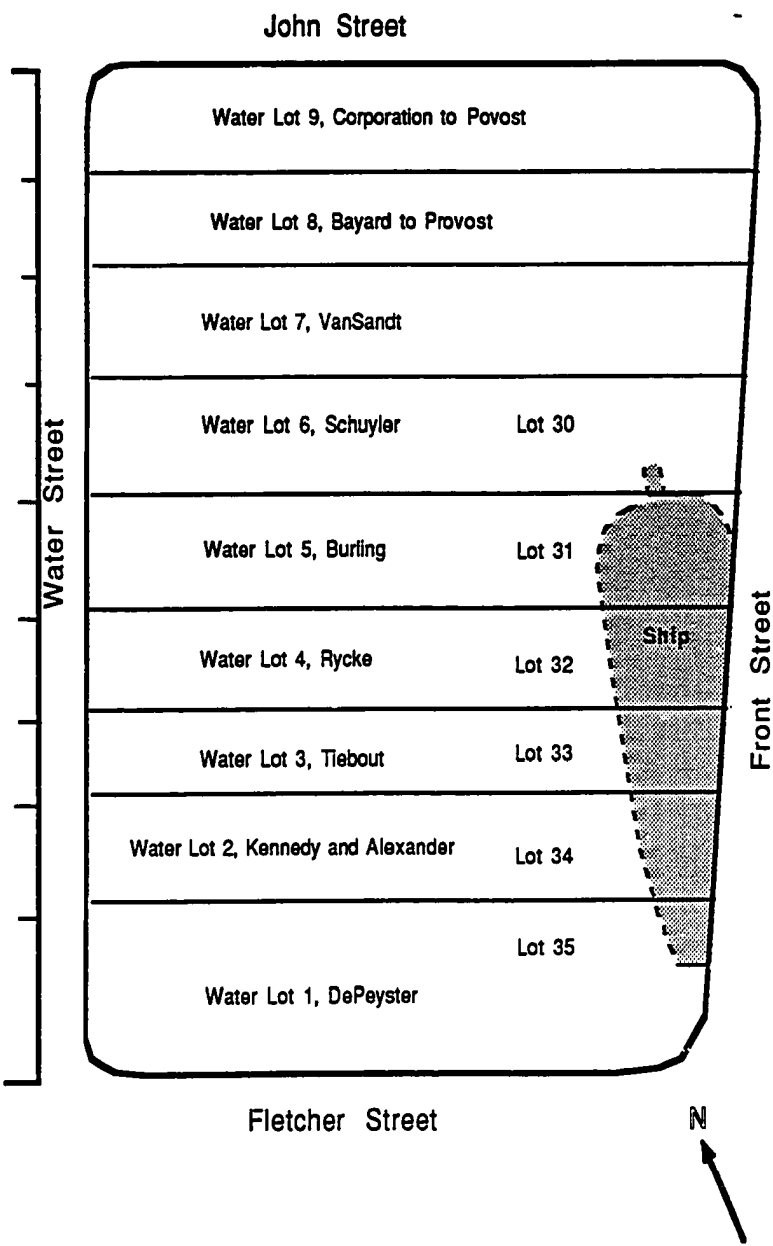


Figure 39. Site map of 175 Water Street with water lots and grantees indicated.  
(W. Riess)

prominent man in New York. He was surveyor of New Jersey, Naval Officer for New York, Kennedy's lawyer, part ship owner, and a merchant who traded overseas. Lot three was granted to John Tiebout, a turner and part owner of the sloop *Mary and Margaret*. Henry Rycke, a blacksmith, received lot four and Edward Burling, a merchant, was granted lot five. Lot six was granted to Elizabeth Schuyler, a widowed merchant who traded overseas and conducted a retail business in New York.<sup>13</sup>

From existing papers left by Alexander and Schuyler, it appears that the lot owners conducted business with each other over a long period of time. Alexander and Schuyler even used the same shipping agent in London, Rodrigo Pacheco. While these papers show the extent of the business dealings of the property owners, no archival record has been found of the methods used to fill the block, or the use of a ship as part of their filling process. However, data obtained from the archaeological investigation of 175 Water Street, which included the Ronson ship site, and the investigation of other sites in Manhattan, provide much complimentary information.<sup>14</sup>

The 175 Water Street block appears to have been filled in four processes which overlapped in time: 1) setting of a crib for the western half of the block, 2) filling of the western half, 3) cribbing the eastern half, and 4) filling the eastern half. Since the results of all four tasks show block-length, rather than water lot-specific, construction, it appears that the water lot owners cooperated closely to improve the block. The tasks can be dated by a combination of archival and artifact-related data.

In the first phase the colonists evidently set an interlocking framework of pine logs throughout the western half of the block sometime between 1737 and 1744 (See Figure 40). A 1735 map shows the area to be part of the East River and the water lot grants were not

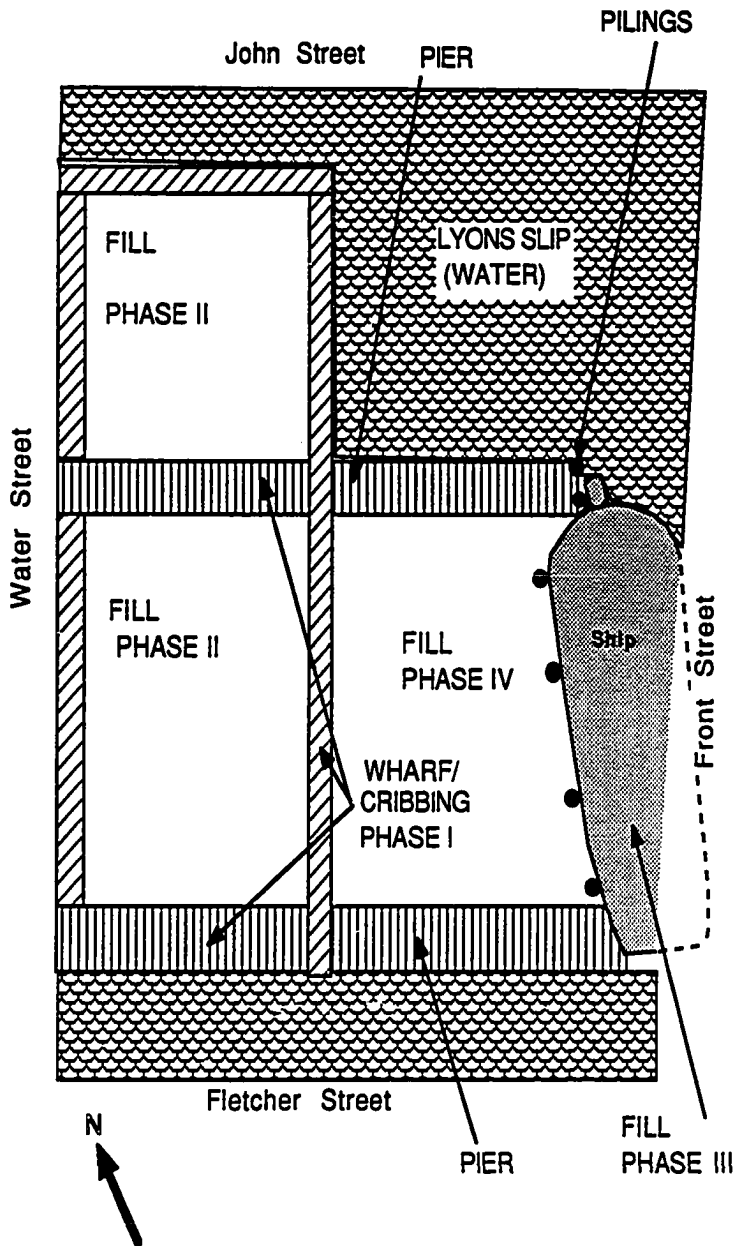


Figure 40. Early development of 175 Water Street, as indicated by archival and archaeological evidence. (S. Smith)



given until 1737.<sup>15</sup> However, Grim's 1744 *A Plan of the City and Environs of New York*, depicts the block as half-filled (See Figures 41 and 42).<sup>16</sup> It also shows that Water Street is fully constructed and widened, a row of buildings is constructed on the west side of the block, and a quay appears to be built out to approximately half of the final size of the lots. Geismar's field team discovered that the framework consisted of a solid perimeter wall of squared pine logs which were anchored in place by vertical piles and deadmen (attached horizontal logs). The deadmen extended perpendicularly to the walls, into the space to be filled. To keep the framework from floating, the builders placed field stones and gravel directly over the lower members of the cribbing.<sup>17</sup> Archaeologists investigating other Manhattan sites report similar cribbing construction north and south of 175 Water Street in the eighteenth century.<sup>18</sup>

The last dates (*terminus post quem*) of the artifacts indicate that phase two, the task of filling the western space, was accomplished over a period of about 40 years, between 1740 and 1795. The fill consisted mostly of trash, garbage, and earth originating on Manhattan. Some lenses of coral sand and cobble stone found in the fill appear to be excess ballast from incoming ships. The archaeological evidence indicates that the process took longer than originally suspected from observing eighteenth-century maps of Manhattan. Geismar reasons that Grim's 1744 map depicted the western cribbing with the space only partially filled. She concludes that the buildings that Grim showed on the site were built on piles over the partially filled cribbed space. She also reports the remains of a 6 by 7 -foot (1.8 by 2.1 m.) cribbed pillar in the western area.<sup>19</sup> The pillar may have supported one of the western buildings.

Phase three took place sometime between 1744 and 1755, when the eastern halves of the water lots were cribbed with a combination of piers and a quay composed of wharfage and the derelict Ronson ship. Maerschalc's 1755 *A Plan of the City of New York from an Actual*

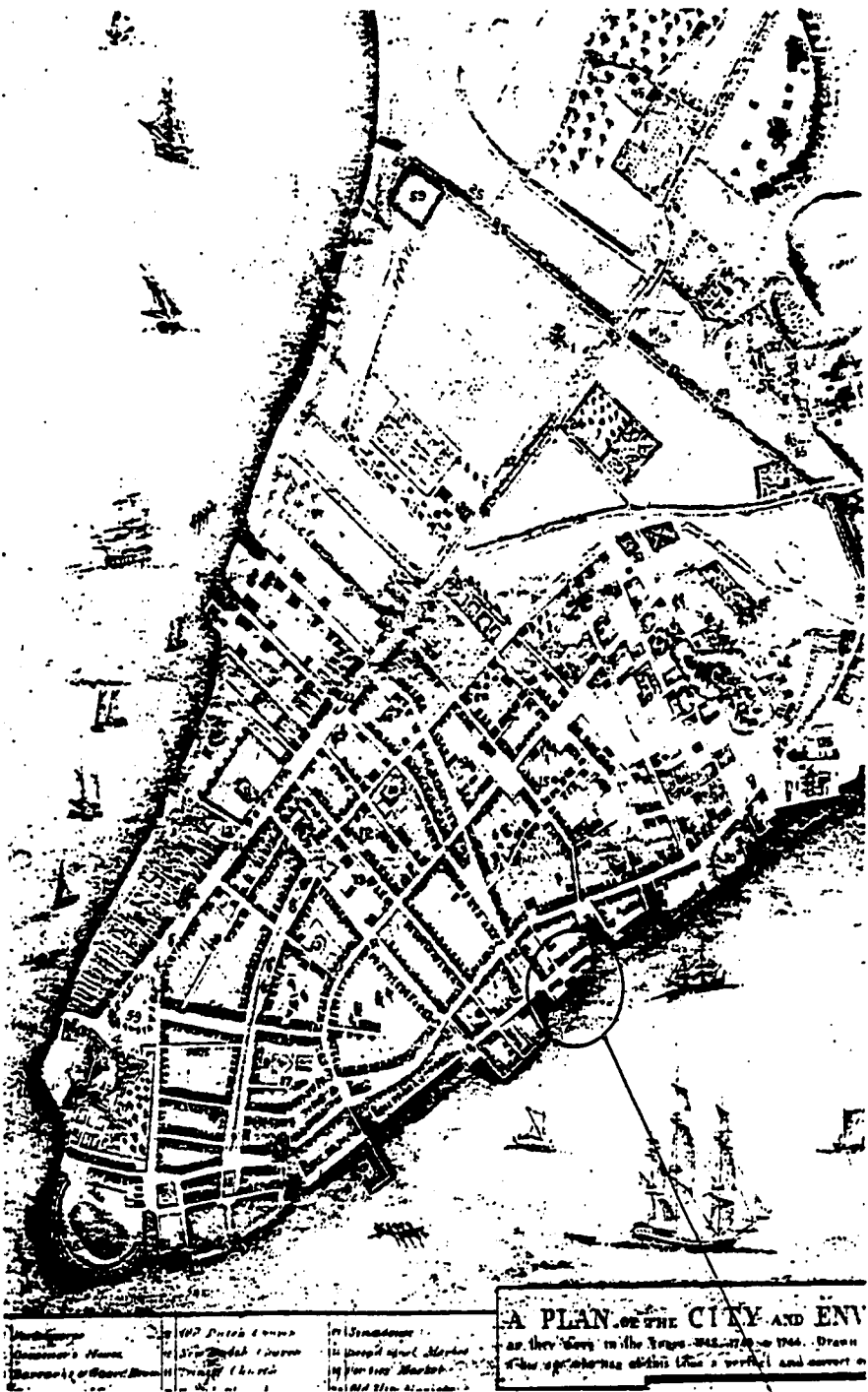


Figure 41. Grim's 1744 "A Plan of the City of New York," showing half of the 175 Water Street block filled. From Issac N. Stoke, *The Iconography of Manhattan Island* (New York, 1915), plate 32.

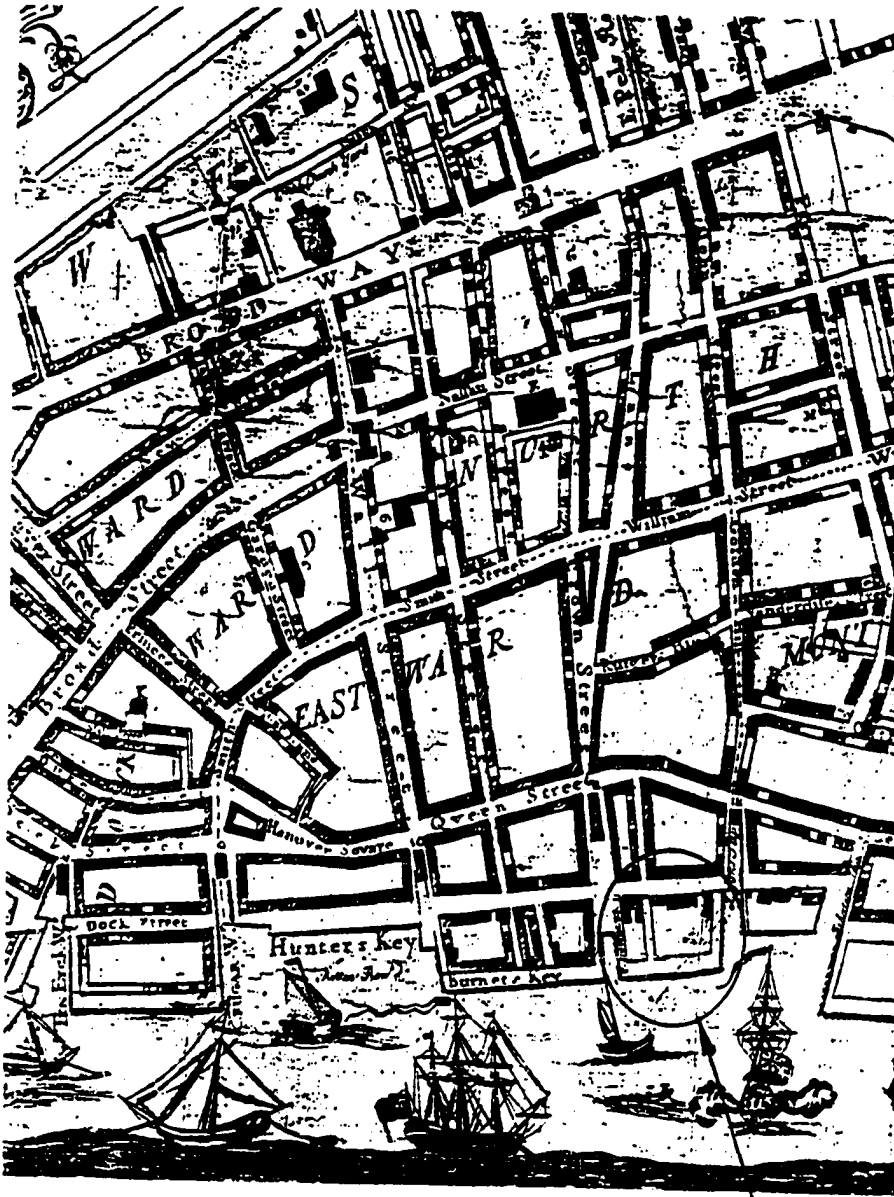


Figure 42. Maerschalc's 1755 "A Plan of the City of New York from an Actual Survey," showing all of the 175 Water Street block filled. From Issac N. Stokes, *The Iconography of Manhattan Island*, 1498-1909 (New York, 1915), plate 34.

*Survey* shows a completed block filled out to the eastern extent of the water lots, bordered at the East River with a new quay or street, and supporting the same buildings in the west that Grim showed (See Figure 41). Except for the ship, and one deep test hole just west of the ship, none of the eastern half of the block was archaeologically excavated. All evidence for the colonial cribbing and filling of the eastern half comes from these two excavations and quick observations made after the archaeological work, when, in two days of work the construction company removed the fill and cribbing with a large backhoe and bulldozer. Although the Maerschallck 1755 *Plan of the City* shows a squared-off eastern quay at the block, we were not able to see most of the crib material which made the eastern quay, except for the ship's hull which was in the approximate center of the eastern wall.

Physical evidence around the ship indicates that two east-west solid wharves extended from the half-way cribbing to the final east wall. At the eastern end, the only part of the construction observed, the piers were made of log cribbing filled with rocks and earth. The bow of the Ronson ship was approximately 2 feet (0.6 m.) east of the eastern end of the northern pier. Next to the ship's knee of the head, two piles were driven into the mud, 2-inch (5 cm.) planks were spiked horizontally to the piles, and more spikes were driven through the planks and into the knee of the head. Similarly, the stern of the ship was spiked to planked piles approximately 2 feet (0.6 m.) from the southern pier's eastern end. The pier met the ship approximately 5 feet (1.5 m.) forward of the transom. We discovered no other means of fastening the ship to something stationary in the mud, though because of the nature of the excavation we may have missed them. Since the bow and stern spikes could offer only a light fastening for the ship, whoever placed the ship there must have intended that the ship be filled quickly to drive it into the mud and keep it in place (See Figure 40).

During the excavation of the Ronson ship, we discovered that the ship had little of its

original hardware aboard. Almost everything that could be carried or detached from the hull had been removed before the ship was filled with extraneous material. Even the lowest layer of fill may not have been part of the ship's ballast. Evidently, the New Yorkers stripped the old merchant ship of its hardware and ballast for salvage and to lighten the hull. They then floated the hull into a position parallel to the shore, spiked it to the horizontal planks mentioned above, and filled it with excess ballast from other ships and soil and refuse from the city. The ship would have been at least partially filled before the block area just west of it was filled, since without the ship being stable in its position the other fill would have slumped into the area occupied by the ship, pushing the ship aside.

An analysis of the stratigraphy and types of material in the ship reveals clues to the filling process. The contents of the Ronson ship consisted of distinct layers of material which were not all level, but were shaped to reveal the state of the ship's decks during the fill process. In the bow area, from the stem to the forward bulkhead, the space below the lower deck was filled with two distinct layers of material. The lower layer sloped down from the bulkhead, while the upper layer was relatively level (See Figure 43). In the main cargo hold, between the two bulkheads, and below the lower deck, five layers formed two humps – one under each of the ship's two cargo hatches. Aft of the after bulkhead, below the lower deck, the fill formed a fairly flat stratigraphy of two layers in a small space.

The shape of the stratigraphy indicated that the existence of the lower deck planks, when the ship was filled, was similar to the way we found it – the bow planks were intact, midship area deck planks were in position and the aft planks were removed. Therefore the workers filled the hull through the main and forward hatches in the cargo hold, while they dropped the fill between the deck beams in the aft section of the ship. The bow fill appears to be a combination of overflow from the forward cargo hatch fill and river silt from openings in the

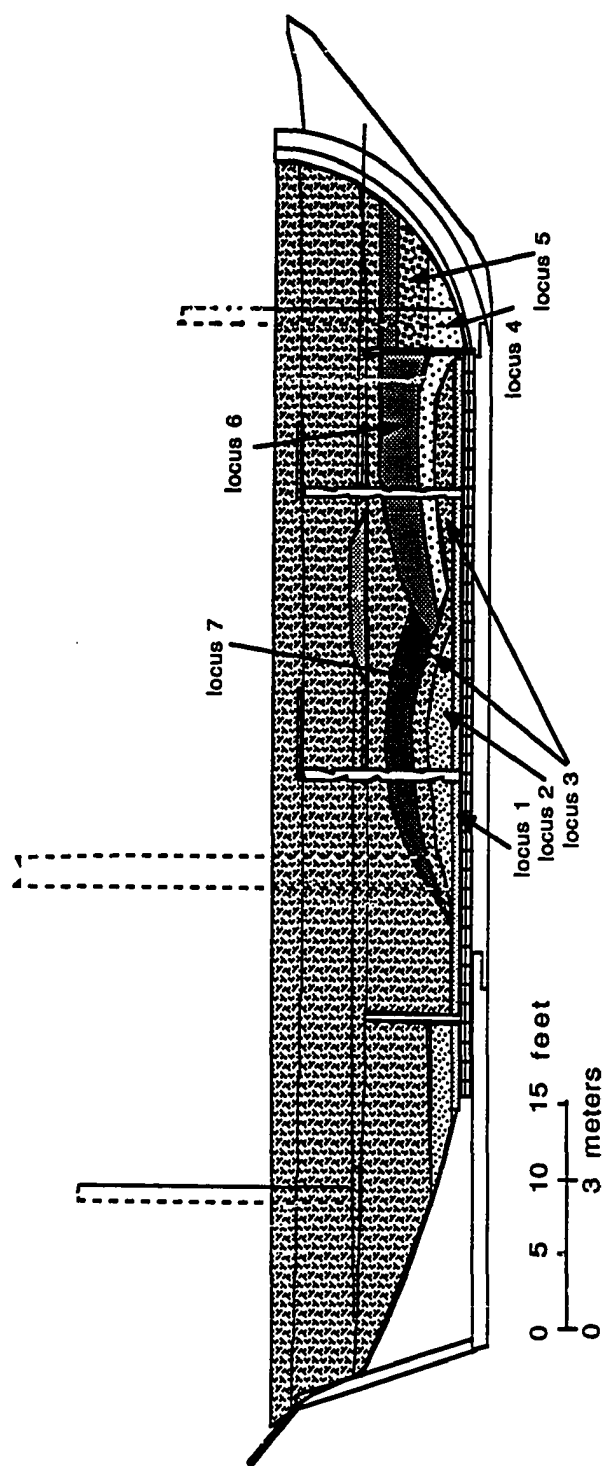


Figure 43. Side view of the Ronson ship, showing the stratigraphy of fill as found in 1982. (W. Rless)

hull's bow. A consideration of each fill layer makes this interpretation clearer.

The lowest layer of fill, designated locus 1, in the ship was a mixture of small tropical shells, coral sand, and silt. It lay relatively flat on the ceiling planks, averaging 8 inches (20 cm.) thick, and extended from aft of the forward bulkhead to at least the main mast. The aft end of locus 1 was in a wall we could not excavate and the layer did not exist in lot 35, where the distance between the lower deck and the ceiling planks was less than 2 feet (0.6 m.). Artifacts found in this layer date to the early eighteenth century, with a last date of c.1720.<sup>20</sup> We could not determine whether locus 1 was the original ballast of the ship or ballast shovelled in from another ship. The types of shells and coral indicated that it was not from a local source. Since this layer was flat and subsequent layers in the main cargo hold formed piles under the cargo hatches, there is a good possibility that locus 1 was the remains of some of the Ronson ship's last sailing ballast. If that were so, the artifacts indicate that the ship stopped sailing sometime shortly after 1720.

The first fill we can be sure was added to the ship was a small layer, locus 2, of coral sand and gravel below the main cargo hatch and in the after storage space. It formed a pile approximately 2 feet (0.6 m.) high directly under the hatch and a 1-foot (0.3 m.) layer in the after section. The layer contained artifacts with a last date of 1744. The shapes of loci 1 and 2, and the twenty-four year difference between the *terminus post quem* dates of the layers suggest that the ship ended its sailing career shortly after 1720, remained in the harbor as a hulk for about twenty years, and then was buried after 1744. Locus 2 formed a pile of coral sand and gravel which probably was excess ballast on a ship entering New York's port. After unloading her cargo, the crew pulled the ship alongside the Ronson ship and unloaded her excess ballast through the Ronson ship's main cargo hatch with baskets or pails.

Above the coral sand and gravel was locus 3, a layer of cobbles, pieces of coral, and silt. The silt may have been river silt which found its way into the hold through breaks in the hull, before and after the cobbles and coral were dropped into the ship. The cobbles were a mixture of large beach stones and English flint, while the coral were mostly pieces of brain coral. This third layer apparently was dumped down through the two cargo hatches and between the deck beams in the ship's after section, forming two connecting piles in the cargo hold and lenses of fill in the after provisions section (lot 34). The artifacts among locus 3, and subsequent layers up to the lower deck, are all dated earlier than 1748. The one exception, which may have been an intrusive piece fallen from the walls above, is a ceramic sherd with a *terminus post quem* of 1765.

A crew of a third ship dumped more coral sand and gravel ballast down the forward cargo hatch only, creating a pile under the hatch. The pile, locus 4, extended aft approximately 15 feet (4.5 m.) from a point below the forward hatch's center. The center of the forward part of the pile evidently poured over the sill of a forward bulkhead hatch, spilling into the bow area and forming the lowest layer of fill in the ship's bow. The bow must have been filled with water and some river silt already, for the fill that spilled into the bow settled horizontally, rather than at an angle as the side of a pile, and it was darker than the rest of the layer in the cargo hold.

Above the spilled layer was locus 5, approximately 2 feet (0.6 m) of river silt, sand, and wood chips with few artifacts. The only way fill could enter was through the bulkhead hatch, or through breaks in the side of the ship, because the lower deck in the bow was still extant when we excavated the ship, and we found no hatch in it. Since none of the material from locus 5 was found aft of the bulkhead hatch, the layer was probably a deposit of river-born material which came through breaks in the hull. Accordingly, it contained almost no artifacts. The



layer may have been pushed up by the settling of the lower layer, or come in after the lower layer had settled. These leaks in the bow may have been the cause of the ship's being abandoned.

To fill the forward area below the lower deck, workers then dumped loads of red-brown sandy silt with gravel (locus 6) through the forward cargo hatch. Again the material formed a slope aft of the forward bulkhead and a level layer in the bow. The material appears to be from the river bottom and may represent dredged material which accumulated in the man-made slips between the blocks. The eighteenth-century New Yorkers recorded the job of dredging the slips, but did not mention where they dumped the dredged silt.<sup>21</sup> The Ronson ship would have been a handy receptacle for the dredgers.

Locus 7, the last layer of fill below the lower deck consisted of another quantity of coral sand and gravel. Apparently the colonists dumped it through the main hatch and between the deck beams aft, forming a small pile in the cargo hold and a relatively flat layer in the after storage space. A space was left between locus 7 and the lower deck.

Above the lower deck three distinct fill patterns existed in the bow, midships area, and stern respectively. In the bow locus 8, another 2-foot (0.6 m.) layer of river dredge, was above the deck planks. Above the dredge material locus 9 was a layer of red-brown sand with a mixture of later eighteenth- and nineteenth-century artifacts. This material appeared to be fill from Manhattan, including pockets of earth, garbage, and commercial trash. In the midships area the upper deck was left in place and the space between decks was filled with locus 10. This was primarily comprised of late-eighteenth- and nineteenth-century land-based fill with some pockets of cobbles which may have been from the land or ballast from another ship. On the upper deck were the remains of a small campfire, complete with

stones and charred deck planks, indicating that the deck remained uncovered for at least a short time. From just aft of the main mast to the stern the upper deck was removed and the remaining upper space on the ship was filled with locus 11, composed of late-eighteenth- and nineteenth-century land-based fill. Eventually the weight of the last fill caused the decks to collapse in the bow and above the cargo hold.

Above the final layers were the basement floors of nineteenth-century buildings, that had been constructed with brick and concrete and waterproofed with a 1-inch (2.5 cm.) layer of asphalt below the basement floors. Outside of the ship in the bow and stern, most of the material appeared to originate on land. Next to the bow was a small cache of fine pottery which may have been broken in transit and discarded upon unpacking. Since time constraints precluded obtaining enough additional data about the fill between the ship and the half-way cribbing, the tale of the creation of 175 Water Street can not be completed.

The lower stratigraphy within the ship was composed of ships' ballast, river silt, and gravel. The upper stratigraphy came from shore, but whether it was moved to the site in the mid-eighteenth century or later is not clear. If the ship were completely filled by 1756 to satisfy the water lot grants, then possibly lighters moved the land refuse to the ship. The process would have included unloading wagons of fill into lighters at a slip, moving the lighters to the ship's side, and then unloading the fill by carrying it over the sides of the ship. However, since a bulk wall existed approximately 60 feet (18 m.) to the west of the ship and the ship and attached piles were a steady base, the construction of a sturdy pier to handle wagons may have been more efficient than using lighters. We found no archival or archaeological indication of which technique was used.

Evidence from maps and city records indicates that in the late eighteenth and early

nineteenth centuries the area was filled out another block into the river and filled vertically another 6 to 8 feet (1.8 to 2.4 m.). During the nineteenth and early twentieth centuries merchant stores, warehouses, and apartments occupied the block between Fletcher and John Streets. This was a bustling area of New York's import merchant trade, that was also close to the fish market area.

During the twentieth century, lower Manhattan grew vertically. Skyscraper office buildings began to surround the block and in 1960 the nineteenth-century buildings on it were leveled to form an asphalt-paved parking lot. In 1981 developer Howard Ronson applied to the city to construct a thirty-story office building which would cover the whole block, now called 175 Water Street. He was required by the New York Landmarks Commission to conduct a preconstruction historical and archaeological investigation, which was the catalyst for this study.

From archival data, the state of the ship's remains, and the type and stratigraphy of the site's fill, a history of the extension of a block of land into the East River can be derived. The colonists seem to have accomplished the feat in four overlapping phases, each requiring several years to complete. First they constructed a north-south cribbing wall at half the length of their water lots sometime between 1737 and 1744. Second, starting c. 1737 and ending c. 1795 they filled the western area between the shore and new cribbing. Third, between 1746 and 1755 workers created a second crib at the east end of the lots using a derelict merchant ship and some piles. Finally, the eastern half of the block was filled during the mid-eighteenth to early-nineteenth centuries. Close cooperation among the water lot owners to expand the waterfront was proved by the block-wide, rather than water lot-specific, construction of the area. In addition, the evidence shows how a rapidly expanding Manhattan efficiently utilized its waste to serve the needs of the community.

Since the archival records show that the water lot owners conducted other business with each other, their cooperation in filling the block comes as no surprise. The relatively common cribbing techniques, including the use of the derelict ship, could also be expected. Though current investigations of the history of other blocks on Manhattan's former East River waterfront show some similarities to 175 Water Street, this block does not appear to be a standard model for the shoreline expansion process on Manhattan. In fact no standard model appears to exist. Rather, it appears that the New Yorkers, filling each block as a separate project, used one or more of several possible processes depending on a combination of local needs and available resources.

## NOTES, CHAPTER SIX

1. William R. Shepherd, *The Story of New Amsterdam* (New York, 1926), 5.
2. Berthold Fernow, "Peter Stuyvesant, The Last of the Dutch Directors, 1647-1664." *The Memorial History of the City of New York, From its First Settlement to the year 1892* (New York, 1892), James G. Wilson (ed.), Vol. 1, 257.
3. Shepherd, *New Amsterdam*, 161.
4. Robert G. Albion, *The Rise of New York Port (1815-1860)* (New York, 1939), 2-3, 80-81.
5. As quoted in Bayrd Still, *Mirror for Gotham* (New York, 1956), 17.
6. P.R.O., Col., New York N.O.S.L., 1715-1749.
7. Albion, *New York Port*, 2-6.
8. Norman Brouwer, "The Ship in Our Cellar," *Seaport*, 14.3, 20-23. Amy Friedlander, "Historical Research," (Joan Geismar, ed.), *The Archaeological Investigation of the 175 Water Street Block, New York City* (Marietta, Georgia, 1983), Vol.1, 32. Andrea Heintzelman, "Colonial Wharf Construction: Uncovering the Untold Past," *The Log of Mystic Seaport*, 37.4, reference note 31.
9. Issac N. Stokes, *The Iconography of Manhattan Island, 1498-1909* (New York, 1915), Vol.1, 243.
10. Stokes, *Iconography*, 271.
11. Wendy Harris, *Historical Background Study of Block 74W* (New York, 1980), 6.
12. Friedlander, "Historical Research," 25-30.
13. Friedlander, "Historical Research," 23-29.
14. Rodrigo Pacheco, Alexander Papers (1737-1746), Box 6. Ann Schuyler, Account Book, 1737-1769.
15. "Plan of the City of New York in the Year 1735," in Stokes, *Iconography*, plate 30.
16. Grim, "A Plan of the City," in Stokes, *Iconography*, plate 32a.
17. Joan Geismar (ed.), *The Archaeological Investigation of the 175 Water Street Block, New York City* (Marietta, Georgia, 1983), Vol. 2, 689.
18. Geismar, *175 Water Street*, 689.
19. Geismar, *175 Water Street*, 692-693.

20. Geismar, *175 Water Street*, 697-698.

21. Geismar, *175 Water Street*, 679.

## CHAPTER SEVEN      CONCLUSIONS

Prior to 1982, early eighteenth-century merchant ships were small representations on works of art and were statistically interesting carriers of cargo to and from the American colonies. Archival and archaeological evidence of their design and construction were minimal. Drafts in Fredrick Chapman's 1768 publication were the earliest surviving sources on the design of common transatlantic merchantmen. Little was known about how the ships were able to carry their recorded cargo, sail with a diminished crew, and how they handled at sea. Then in 1982 the discovery, excavation, and recording of the Ronson ship site allowed a new interpretation of the ships and the world in which they existed.

A study of the site has answered some important questions while posing even more. The inability to determine the exact identity of this ship necessitated an analysis of data to narrow-down its probable origin, life, and eventual demise. By combining facts with probabilities from morphological, archaeological, biological, and archival research, I arrived at a hypothesis about the ship's generic identity. Morphological data indicates that she was a British Empire merchant frigate with flat floors, built to sail into shallow as well as deep water, and that she was abandoned because she had outlived her usefulness. The artifacts found in the hull also suggest that she was a British Empire ship, retired about 1720 and buried between 1747 and 1760. Biological analysis indicates that the ship may have been built in Virginia or the Carolinas, was used for seven-to-fifteen years, and was in a warm water port during the last three years of her sailing career. These conclusions suggest that the ship was built sometime between 1700 and 1720. Archival research

narrows the ship's probable identity to a Virginia-built ship which was buried in Manhattan between 1747 and 1755. What happened to the ship between her launching in Virginia and her demise in New York can only be surmised by developing the story of a "typical" Virginia-built tobacco ship.

Beyond providing evidence of her own history, the Ronson ship's greatest contribution lies in her reflections on ship design, construction, and use during America's colonial period. Since most early eighteenth-century Virginia-built ships traded in the shallow waters of Chesapeake Bay to obtain cargos of tobacco, the shallow-draft Ronson ship probably was built to be a tobacco carrier operating between the Chesapeake and England or Scotland. To be successful in this trade, the ship needed to sail well, have a relatively high cargo-to-crew ratio, be able to navigate in shallow water, and sit properly when aground. Continental flyboats, captured by the British during the War of Spanish Succession (1701-1713), possessed many of these qualities, especially a high cargo-to-crew ratio and a flat bottom. Yet, the nature of the British American trade demanded a strong ship which sailed better than the flyboats. The designer of this ship, or ship type, appears to have given it these properties by combining the features of an English merchant frigate with those of a continental flyboat. The design retained the bow and stern of the older English merchantmen and included the relatively flat-bottomed midship cross section of the fly boats. Though one should be careful not to generalize from one example, the economics inherent in this ship may be indicative of the reasons why British merchantmen played such an important role in the expansion of their empire in the eighteenth century. The new ships were much more economical to run and yet were approximately as safe as the older frigate merchantmen. Cutting the cost of transportation between parts of the Empire was a major factor in strengthening its network and supporting its expansion.

Before this study, little was known of the ship design methods of the period, except that



substantial changes took place between the late seventeenth and late eighteenth centuries. Anthony Deane's 1670 treatise on the geometric method of designing warships and Fredrick Chapman's 1768 collection and discussion of merchant ship design were the only surviving material on ship design within fifty years of the Ronson ship's construction. Deane presented a design technique that consisted of a combination of sweeps and straight lines, believed to have been used in the sixteenth and seventeenth centuries. Chapman's design method, which included mathematical considerations of sailing characteristics, represented the new scientific awareness of the eighteenth century. The shape of the stem and cross sections of the Ronson ship indicate that it was designed with sweeps and straight lines in a simple geometric method similar to, but different from, that described by Deane.

In addition, square frames were used for the bow of some ships in the mid-seventeenth century, but by the mid-eighteenth century they were dropped in favor of cant frames. The Ronson ship builder's use of square frames and the designer's use of the geometric method, for a new type of ship developed in the early eighteenth century, indicate the continuation of traditional design and building methods for merchant ships into the early eighteenth century.

I found no evidence to suggest whether or not the designer of this ship was also the builder. However, evidence indicates that the shipwright knew the shape of each frame before he started building. He either shaped and built each frame on a scribe board at the construction site or shaped and erected a series of deal patterns which guided the construction of the frames. The builder was careful to be accurate when he formed those parts of the ship defined by the designed lines of the hull, such as the rabbet of the stem and the outer surface of the breast hooks. His lack of twentieth century-style precision throughout the rest of the ship was quite evident, though the ship was still carefully made to be strong and tight. In order to be more precise the shipwright would have had to expend more time cutting larger timbers to a series of uniform shapes. The use of calking between the ceiling planks, lead

calking strips in the bow, and tongue-and-groove paneling over the ceiling planks in the aft storage area indicate that special attention was given to be sure that the ship was as watertight as possible, even if these precautions added to the expense. It appears that his main concern was to build a strong, watertight ship that was the right shape, by the most economical means.

If indeed the ship was Chesapeake-built and intended for the profitable tobacco trade, she probably carried tobacco, cask staves, and other southern products to Britain and returned with various manufactured and finished goods for the colonists as it generally followed a shuttle pattern between two ports. To acquire its colonial cargo, the master could have taken advantage of its shallow draft to pick up casks and staves in the upper reaches of the Chesapeake. Lading the ship would have included using the fifty foot long cargo hold and the between decks area above it, leaving little enclosed space for the crew.

Wear marks, repairs, and teredo damage indicate that the sailing career of the ship was probably about average for an eighteenth century merchantman -- between seven and fifteen years. Initial analysis of the hull suggests that the ship handled well at sea with a relatively small crew. This was not a fast ship by almost any comparison; six knots with a favorable wind was probably all the crew could manage. If she sailed with the annual Chesapeake convoy there was little need for speed or a large crew to sail and defend her. The economics of shipping are clearly reflected in the Ronson ship. Her owners needed a strong, watertight ship which could sail with a maximum cargo-to-crew ratio possible for the tobacco trade. The capital investment of building the ship, balancing replacement-vs.-repair, and expected return in her short career were all factors which had to be considered in her design and construction.

Why this vessel ended in New York is not clear. Had her rugged life caught up with her?

Had she fallen prey to privateering? Whatever the reason, sometime around 1720 the ship made her final voyage into the East River and the burgeoning young port of New York. There she may have floated in New York Harbor as a storage hulk for a number of years before being used for the extension of the land. Merchants may have used her to store products from the hinterland while waiting for another ship to arrive. It may have held goods from abroad while merchants found buyers. In the interim, the colonists began filling the western half of the block that would become 175 Water Street. Some time around 1747 the ship was stripped of all her hardware, towed slowly into place along the shallow river bank, and spiked to piles driven into the harbor mud approximately 200 feet (60 m.) to the east of Water Street. In order to keep the hull in place, workers filled the stripped hull with excess ballast from other ships, creating a new crib which was used to contain the fill in the western half of the block. The ballast of incoming ships, which formed discrete piles within the Ronson ship, reflect the variety of ships calling at New York. A campfire, small capstan, and mizzen mast butt found on the ship served cargo handlers of the port while the filled ship temporarily served as a new quay in the second half of the eighteenth century. One can easily visualize dockworkers, standing near the camp fire to keep warm on a winter day, waiting to unload a new cargo of British goods into wagons pulled by teams of steaming horses which also waited on the quay. Like men today, they probably wondered about the ship below their feet.

Eventually, the land was extended another 200 feet to the east and raised another 8 feet with nineteenth-century fill. The ship was forgotten as a small incident in Manhattan's history. Thus the builders of New York left us a riddle which we are only now beginning to solve. Some of the data we recorded from the physical remains clearly indicated particular interpretations while the rest of the material did not support conclusive analyses. Similarly, because of the nature of the physical remains, archival research was often inconclusive in this study. Yet, I hope that this interpretation, which combines physical and archival data from one ship, has provided a better view of eighteenth-century merchantmen.

Future research, of material remains and archival evidence of this and other ships, may resolve some of the unanswered questions concerning the ships which connected the peoples of the eighteenth-century British Empire.

## BIBLIOGRAPHY

### Manuscript Sources

- "Alexander Papers." MS., New York Historical Society.
- Bancker, Christopher And Evert Waste Book, 1742-1762. MS., New York Historical Society.
- Bancker, Christopher And Evert Account Book, 1742-1762. MS., New York Historical Society.
- Bancker, Evert Account Book, 1760-1765. MS., New York Historical Society.
- Chapman, Fredrik Henrik af. "The Chapman Collection [1743-1768]." MS., Swedish Maritime Museum, Stockholm. On microfilm.
- Cunningham, Waddel. *Letter Book*, 1756-1757. MS., New York Historical Society.
- Cuyler, Philip. *Letter Book*, 1755-1760. MS., New York Historical Society.
- P.R.O., Vice-Admiralty Court Of New York. On microfilm.
- P.R.O., C.O., New York Naval Office Shipping Lists. 1715-1749. On microfilm.
- P.R.O., C.O., Virginia Naval Office Shipping Lists. 1698-1769. On microfilm.
- Schuyler, Ann E. "Account Book of Ann Elizabeth Schuyler, 1737-1769." MS., New York Historical Society.

### Published Primary Sources

- Chapman, Fredrik Henrik af. *Architectura Navalis Mercatoria*. New York: Praeger Publishers, 1971 [originally published Stockholm, 1768].
- Deane's Doctrine of Naval Architecture*, 1670. Brian Lavery, ed. Greenwich, U.K.: Conway Maritime Press, 1981.
- Murray, Mungo. *A Treatise on Ship-building and Navigation*. London: A. Millar, 1754.
- Salisbury, William and R. C. Anderson, eds. *A Treatise on Shipbuilding and A Treatise on Rigging Written About 1620-1625*. London: Society for Nautical Research, 1958.

Sutherland, William. *The Shipbuilder's Assistant, or Marine Architecture*. London: Mount and Davidson, 1726.

P.R.O., C.S.P., Col., Vols. 13-16.

### Newspapers

*New York Gazette and Weekly Post Boy*. Jan 1732-Dec. 1759. New York Historical Society. On microfilm.

*The Virginia Gazette*. 1732-1741. The Mariners' Museum. On microfilm.

### Archaeological Site Reports and Articles

Albright, Alan B. and J. Richard Steffy. "The Brown's Ferry Vessel, South Carolina," *International Journal of Nautical Archaeology* 8 (1979): 121-142.

Geismar, Joan H. *The Archaeological Investigation of the 175 Water Street Block, New York City*. Marietta, Georgia: Soil Systems, Inc., 1983.

Huey, Paul R. "Old Slip and Cruger's Wharf at New York: An Archaeological Perspective of the Colonial American Waterfront," *Historical Archaeology* 18 (1984): 17-37.

Jagels, Richard. "Anatomical, Mechanical, and Chemical Analysis of the Ronson Ship Timber," *Proceedings of the Society for Historical Archaeology*, 1987. To be published.

Ringer, James R. "The Marine Excavation of the 16th Century Basque Whaling Vessel *San Juan* in Red Bay, Labrador: A Summary of the 1982 Field Season," *Proceedings of the 14th Conference on Underwater Archaeology*. San Marino, California: Fathom Eight Publications, 1986, 119-124.

Ringer, James R. and Michel J. Audy. "Cargo Lading and Ballasting on the 16th Century Basque Whaling Vessel *San Juan* (1565)," *Proceedings of the 13th Conference on Underwater Archaeology*. San Marino, California: Fathom Eight Publications, 1982, 20-22.

Rosloff, Jay P. "The Water Street Ship: Preliminary Analysis of an Eighteenth-Century Merchant Ship's Bow." Master's thesis, Texas A&M University, 1986.

Seifert, Betty and Richard Jagels. "Conservation of the Ronson Ship's Bow," *Waterlogged Wood: Study and Conservation*. Grenoble: Centre D'Etude et de Traitement des Bois Gorges D'Eau, 1984, 269-297.

Smith, Sheli O. *Survey of a 17th Century Shipwreck Site at Isle aux Mortes, Newfoundland*. Bristol, Maine: M.A.H.R.I., 1983.

- Smith, Sheli O. "The *Defence*: Life at Sea as Reflected in an Archaeological Assemblage from an Eighteenth-Century Privateer." Ph.D. diss., University of Pennsylvania, 1986.
- Smith, Sheli O. "The Ronson Ship: The Ship," *Proceedings of the Society for Historical Archaeology*, 1987. To be published.
- Steffy, J. Richard. "Construction Details of the Brown's Ferry Ship," *Proceedings of the 9th Conference on Underwater Archaeology*. Austin, Texas: Texas Antiquities Committee, 1978, 55-61.
- Switzer, David C. *Hart's Cove Wreck Site Archaeological Investigation: 1986 Field Report*. Bristol, Maine: M.A.H.R.I., 1986.
- Switzer, David C. "Provision Stowage and Galley Facilities Onboard the Revolutionary War Privateer, *Defence*," *The Proceedings of the 9th Conference on Underwater Archaeology*. Austin, Texas: Texas Antiquities Committee, 1978, 39-44.
- Wyman, David B. "Understanding the Structure of the Privateer *Defence*," *Proceedings of the 13th Conference on Underwater Archaeology*. San Marino, California: Fathom Eight Publications, 1982, 70-71.

### Secondary Material

- Abell, Westcott. *The Shipwright's Trade*. London: Conway Maritime Press, 1948.
- Albion, Robert G. *The Rise Of New York Port [1815-1860]*. New York: Charles Scribner's Sons, 1939.
- Albion, Robert G. *Forests and Sea Power: The Timber Problem of the Royal Navy, 1652-1862*. Cambridge, Massachusetts: Harvard University Press, 1926.
- Baker, William A. *The Development of Wooden Ship Construction: A Brief Historical Survey to the Nineteenth Century*. Quincy, Massachusetts: The Society of Naval Architects and Marine Surveyors, 1955.
- Baker, William A. *Colonial Vessels: Some Seventeenth-Century Sailing Craft*. Barre, Massachusetts: Barre Publishing, 1962.
- Baker, William A. "Vessel Types of Colonial Massachusetts," *Seafaring in Colonial Massachusetts*. Boston, Massachusetts: The Colonial Society of Massachusetts, 1980.
- Boudriot, Jean. *The Seventy-Four Gun Ship. A Practical Treatise on the Architecture*. 4 vols. Translated by David Roberts. Beccles, U.K.: William Clowes, Ltd., 1986.
- Brain, Jeffrey P. *Tunica Treasure*. Cambridge, Massachusetts: Harvard University Press, 1979.

- Braudel, Fernand. *The Structures of Everyday Life: Civilization and Capitalism, 15th-18th Century*. 2 vols. New York: Harper and Row, 1979.
- Brouwer, Norman. "The Ship in Our Cellar," *Seaport* 14.3 (1980): 20-23.
- Chapin, Howard M. *Privateering In King George's War, 1739-1748*. Providence, Rhode Island: E. A. Johnson Co., 1928.
- Chapelle, Howard I. *The History of American Sailing Ships*. New York: Bonanza Books, 1935.
- Clowse, Converse D. "Shipbuilding and Shipowning in Colonial South Carolina: An Overview," *The American Neptune* 44 (1984): 221-244.
- Davis, Ralph. *The Rise of the English Shipping Industry in the 17th and 18th Centuries*. Devon, U.K.: David and Charles, 1972.
- French, Christopher J. "Eighteenth Century Shipping Tonnage Measurements," *Journal of Economic History* 33 (1973): 434-443.
- Friedlander, Amy. *175 Water Street History*. Marietta, Georgia: Soil Systems, Inc., 1981.
- Goldenberg, Joseph A. *Shipbuilding In Colonial America*. Charlottesville, Virginia: University Press Of Virginia, 1976.
- Harlow, W.M. et al. *Text Book of Dendrology*. New York: Sterling Publishing, 1950.
- Harman, Joyce Elizabeth. *Trade And Privateering In Spanish Florida 1732-1763*. Jacksonville, Fla.: Paramount Press, 1969.
- Harrington, Virginia D. *The New York Merchant On The Eve Of The American Revolution*. New York, 1935.
- Heintzelman, Andrea. "Colonial Wharf Construction: Uncovering the Untold Past," *The Log of Mystic Seaport* 37 (1986): 124-135.
- Lanier, Monro B. *History of Southern Shipbuilding*. Pascagoula, Mississippi: Ingalls Shipbuilding Corp., 1953.
- Lavery, Brian. *The 74-Gun Ship Bellona*. Annapolis, Maryland: Naval Institute Press, 1985.
- Lydon, James G. *Pirates, Privateers, And Profits*. Upper Saddle River, N.J.: Gregg Press, 1970.
- MacGregor, David R. *Merchant Sailing Ships 1775-1815: Their Design and Construction*. Watford, U.K.: Argus Press, 1980.



- Marsden, Peter. *The Wreck Of The Amsterdam*. New York: Stein And Day, 1975.
- McCusker, John J. "Colonial Tonnage Measurement: Five Philadelphia Merchant Ships as a Sample," *Journal of Economic History* 27 (1967): 82-91.
- McCusker, John J. and Russel R. Menard. *The Economy of British America, 1607-1790: Needs and Opportunities For Study*. Williamsburg, Virginia: Institute of Early American History and Culture, 1980.
- Middleton, Arthur Pierce. *Tobacco Coast: A Maritime History Of Chesapeake Bay In The Colonial Era*. Baltimore, Maryland: John Hopkins University Press, 1984.
- Noël Hume, Ivor. *A Guide to Artifacts of Colonial America*. New York: Alfred A. Knopf, 1976.
- Noël Hume, Ivor. *Martin's Hundred*. New York: Alfred Knopf, 1982.
- Pares, Richard. *Yankees & Creoles; The Trade Between North America and The West Indies Before The American Revolution*. London: Green, 1956.
- Pares, Richard. *War And Trade In The West Indies, 1739-1774*. Oxford: Clarendon Press, 1936.
- Pares, Richard. *Colonial Blockade And Neutral Rights, 1739-1763*. Oxford: Clarendon Press, 1938.
- Riess, Warren C. "The Phantom Pyramid, A Trilateration Measuring System." Paper presented at the Conference on Underwater Archaeology, Denver, Colorado. January 1983.
- Ross, Lester A. *Archaeological Metrology: English, French, American, and Canadian Systems of Weights and Measures for North American Historical Archaeology*. Ottawa, Canada: Parks Canada, 1983.
- Ross, Lester A. "Sixteenth Century Spanish Basque Coopering," *Historical Archaeology* 19 (1985): 1-31.
- Rutman, Darrett B. and Anita H. Rutman. *A Place in Time: Middlesex County, Virginia, 1650-1750*. 2 vols. New York: W.W. Norton, 1984.
- Sebillé, Albert. *Histoire de la Marine*. Paris: L'illustration, 1934.
- Shepherd, James F. and Gary M. Walton. *Shipping, Maritime Trade, and the Economic Development of Colonial America*. Cambridge: Cambridge University Press, 1972.
- Shepherd, William R. *The Story of New Amsterdam*. New York: Knopf, 1926.
- Ships And Shipping Of Old New York*. Boston: Walton Advertising And Printing, 1915.

- Shumay, Floyd M. *Seaport City, New York In 1775*. New York: South Street Seaport Museum, 1975.
- Still, Bayard. *Mirror for Gotham*. New York: New York University Press, 1956.
- Stokes, Issac. *The Iconography of Manhattan Island, 1498-1909*. New York: Robert H. Dodd, 1915.
- Turner, Ruth D. *A Survey and Illustrated Catalogue of the Teredinidae (Mollusca: Bivalvia)*. Cambridge, Massachusetts: Harvard University, 1966.
- Walton, Gary M. "Colonial Tonnage Measurements: A Comment," *Journal of Economic History* 27 (1967): 392-397.
- Walton, Gary M. and James F. Shepherd. *The Economic Rise of Early America*. Cambridge: Cambridge University Press, 1979.
- Wilson, James G., ed. *The Memorial History of the City of New York, From its First Settlement to the Year 1892*, vol.1. New York: New York History Co., 1892.
- Wood, Virginia S. *Live Oaking: Southern Timber for Tall Ships*. Boston, Massachusetts: Northeastern University Press, 1981.
- Work Projects Administration. *A Maritime History Of New York*. New York: Doubleday, Doran, and Co., 1941.